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NEW ELECTRIC ANNEALING FURNACE

A DESCRIPTION OF AN APPARATUS DESIGNED FOR HEATING METALS UNDER IDEAL CONDITIONS.

An interesting electric heating furnace for annealing brass and German silver flat ware blanks has just been installed in the plant of one of the best known makers of plated table ware in this country, located at Niagara Falls, N. Y. The furnace framework is made of steel shapes and plates, and is 15 feet long, 8 feet wide, and 7 feet 6 inches high. The doors are located at both ends of the furnace.

A mechanical pusher operated by compressed air cylinders running over cast iron idler sheaves operates the pusher mechanism located at the charging end of the furnace. The material under treatment is packed in steel pans 20 inches square which are forced through one after another, seven pans being in the furnace at one time. The pans passing through the furnace are supported by a hearth made of cast iron grids 24 inches square, and are of special design, which prevents undue warping at furnace temperatures. The pan coming out of the discharge end of the furnace is automatically dumped into a water sealed discharge hood. The metal under treatment falls into a tank of either clear water or pickling solution, depending upon the cleanliness of the material before it is charged into the furnace. The pan itself is caught by two rails and held suspended above the trough and may be taken out from under the water sealed hood through the counter-balanced swing door shown in Fig. 2. The operation of the furnace is as follows:

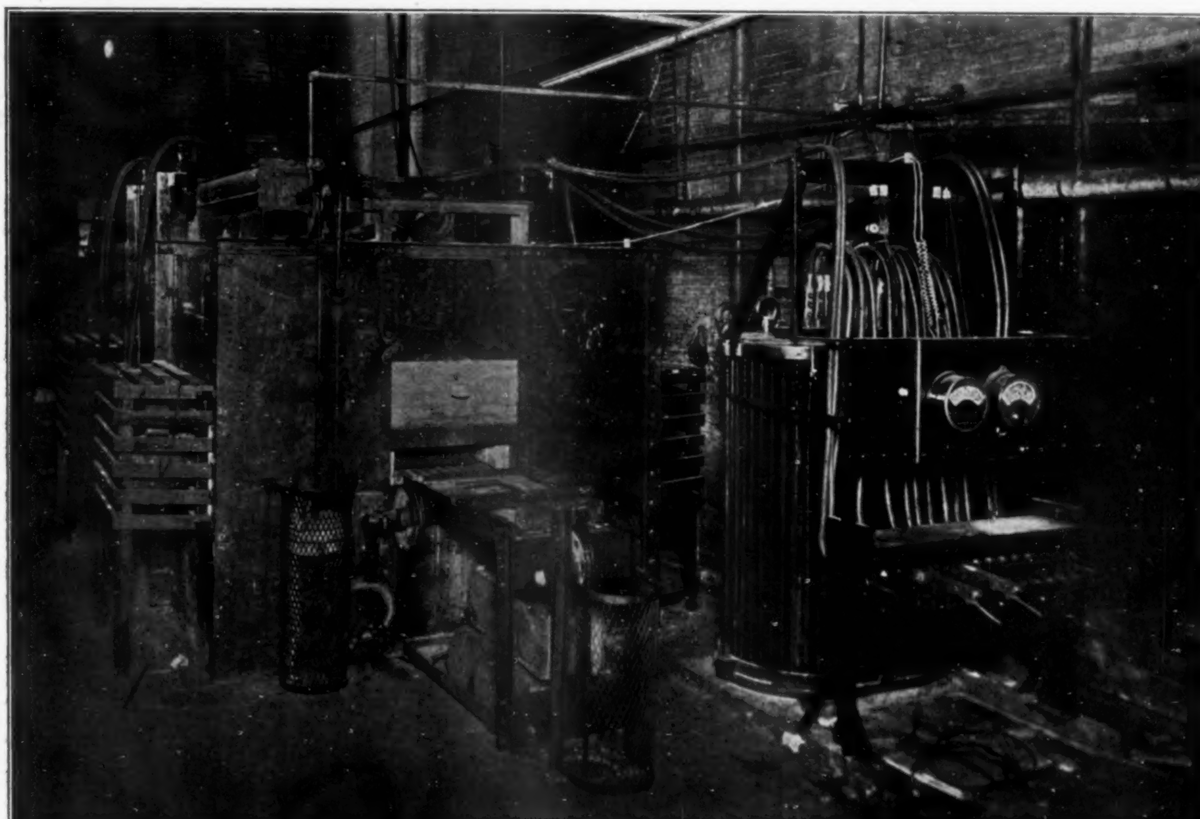


FIG. 1. ELECTRIC METAL ANNEALING FURNACE, INSTALLED IN A NIAGARA FALLS SILVER FACTORY.

A pan of flat ware is placed on the runway in front of the pusher—as shown in Fig. 1. The small hand lever shown near the top of the furnace frame in Fig. 1 is pushed upwards, which operates the air valve on the cylinder shown on the top of the furnace in the same figure. The first movement of the cylinder raises both the front and rear doors to a sufficient height to admit the pans, which are 3 inches high. At this point a stop

on the cable holds the doors at this height, and the pusher with the pan of fresh material starts into the furnace, pushing ahead of it the seven pans already in the furnace. At the moment the fresh pan is completely inside the furnace, the pan at the discharge end has been pushed clear of the furnace opening and door onto a dumping carriage. The weight of the pan striking the base of this carriage automatically tips the pan and it turns completely over, dumping the contents in a hopper, the lower end of which is submerged in the quenching tank. The pan now upside down is caught by two rails and held above the water and is taken out through the counter-balanced swing door shown in Fig. 2.

The material dumped into the quenching tank falls into a perforated copper basket, which is lifted at intervals out of the quenching tank. At the same time that the pan dumping mechanism starts to tilt, the pusher carriage is pulled out of the charging end of the furnace by the counter-balanced door shown in Fig. 1, and immediately after the carriage clears the opening the two doors drop too, simultaneously. It will thus be seen with this furnace that the material is not exposed to the atmosphere at any time after entrance to the furnace until it is taken from the quenching tank cold. This entirely eliminates any possibility of oxidation at any stage during the heating or cooling, as the furnace itself has a reducing atmosphere at all times.

The electrical equipment consists of a special KVA transformer, built by the Pittsburgh Transformer Company, and arranged with 12 voltage taps so connected to

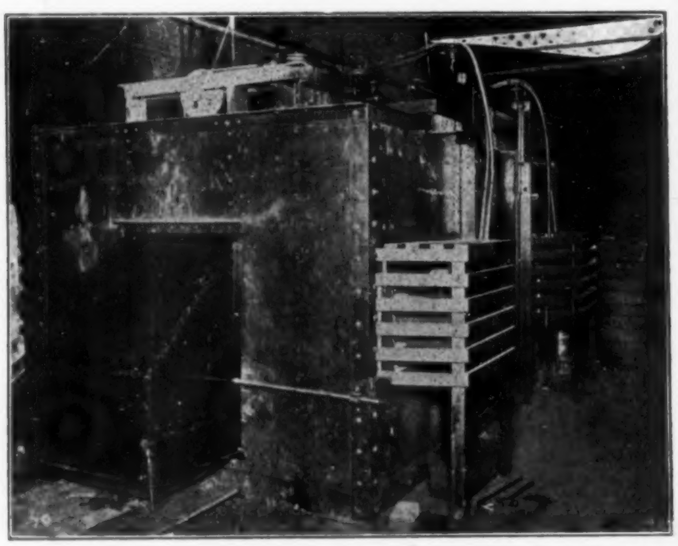
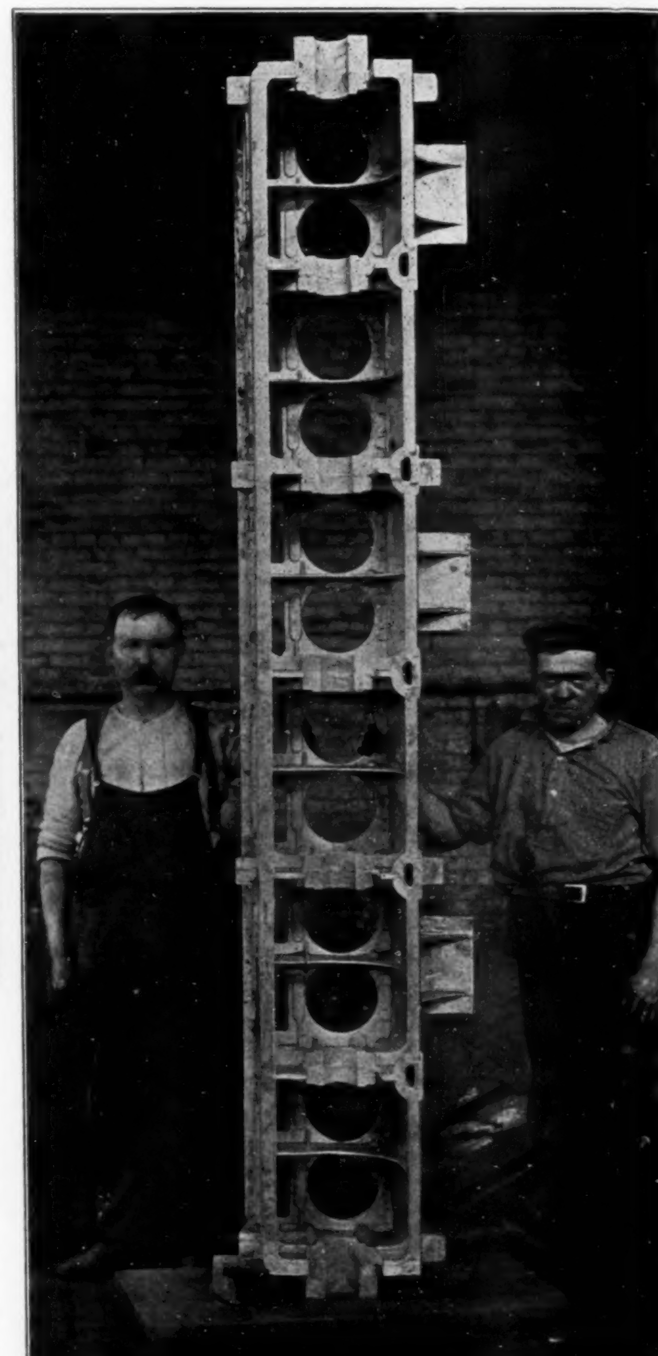


FIG. 2. SHOWING THE WATER-SEALED HOOD THROUGH WHICH THE WORK COMES FROM THE FURNACE.

the special controller shown in Fig. 1. The switching mechanism is so connected with the transformer leads that a very fine regulation of the voltage and hence the wattage may be readily obtained. This switch is mounted on a switchboard frame and is located directly in front of the transformer, as shown in Fig. 1. The instruments on the switchboard panel consist of a Weston watt-meter and Foxboro pyrometer. The latter is connected up with a 48 inch couple placed directly over the pan about to be pushed out of the furnace, thus making it possible to know exactly at what temperature the material is drawn.

The operation of this furnace, it is said, has demonstrated clearly the superiority of continuous electric furnaces for the class of work handled, as the desired temperature may be reached with the utmost precision and without danger of over-heating, and the ruling temperature at the end of the furnace is no higher than the temperature desired in the metal, and further, the furnace atmosphere being always reducing and the material discharged from the furnace quenched from a sealed hood eliminates the two most undesirable features usually found in fuel fired furnaces, namely, lack of uniformity in temperature and oxidizing atmosphere. This furnace was designed and installed by The Electric Furnace Company of America, Alliance, Ohio, who will soon install a second one of the same size and capacity in the same plant.

A REMARKABLE CASTING.



The above casting is one of two aluminum crank cases for a 12-cylinder marine gasoline engine. It was cast by the Standard Brass Foundry Company, of Cleveland, Ohio. The casting weighs 365 pounds and was poured through six runners into a green sand mould.

THE SPOTTING OUT PROBLEM, THEORY AND PRACTICE

SOME ARGUMENTS AS TO THE CAUSE OF THIS VEXING PROBLEM.

BY CHARLES H. PROCTOR.

The paper presented at the annual meeting of the American Institute of Metals, October 13 to 17, 1913, by Messrs. C. F. Burgess and L. T. Richardson entitled "Spotting Out and Silver Plating"* proved to be a very instructive paper and created considerable discussion among the electro-platers of the United States.

Theoretically the paper gave considerable data as to the probable cause of this spotting out, or metallurgical disease, as the learned authors are pleased to term this nightmare or bone of contention of the platers, that persistently occurs when the humid time of summer appears. The paper gave much food for thought to the practical man, but after he had weighed the data carefully in his mind, the fact still remained that theory is one thing and practice another, and that the solution of the distressing problem was just as far off as before.

The writer still believes that the true cause of the difficulty is due to porosity of the metal. While this statement might seem unreasonable as far as rolled sheet metals is concerned, yet nevertheless commercial sheet metals are not free from defects. Even when such defects are very minute, still under the manipulation of the articles in manufacture and in polishing and cleansing previous to plating, the metal is expanded by the heat of the operations. Polishing dirt may be lodged in these minute holes or pores, and the cleansing by the various heated alkaline solutions also expand the metal and small portions of the liquid may become occluded in the articles. When finally plated, and it matters not whether in copper, brass, bronze or silver plate, as long as the solutions are made up from cyanides, a portion of the metallic cyanides also become lodged in the minute holes or pores of the plated surface and produce an oxidizing or discoloring agent which platers are pleased to term spotting-out.

If the theories advanced by Messrs. Burgess and Richardson were the true cause of the distressing problem, then instead of occurring three or four months of the year the trouble would be continuous and never end. Fortunately for the plater the time is limited when the trouble occurs excessively, yet a true solution of the problem for all times would avoid endless trouble for the plater and the manufacturer, which in the past has caused sleepless nights and weary days because the problem has been fairly and squarely up to the plater, especially when rolled sheet metals have been used in the manufacture of the articles. When cast metals are used, the plater sometimes proves an alibi because it is almost impossible to produce a casting free from pits and porous spots, and even segregation below the surface due to the gases becoming occluded when the heated metal is poured in the molds. Naturally as a sponge will hold moisture, so these pores or segregated spots will hold the solutions or liquids in which they become immersed.

Mr. Burgess, in numerous experiments made upon the deliquescent properties of the cyanides of sodium and potassium, proves that the sodium is more deliquescent than the potassium. Yet in practice we know that the properties are just the reverse, carbonates of the sodiums throw off their water of crystallization while the potassium carbonates absorb them.

In a large Western plant where much difficulty was experienced in the spotting-out of silver plated reflectors upon nickel plated brass surface, Mr. Burgess tried to prove by experiments that sodium cyanide was the cause of the trouble. The use of silver chloride containing from twenty-five to thirty per cent. of chlorides which form sodium chloride by decomposition is no doubt an accelerating agent and assists in the formation of these spots in the presence of moisture. Acting upon the results of the experiments made by Messrs. Burgess and Richardson an entire new silver solution was made up from potassium cyanide and silver cyanide and water. No other inert material or additional agent was added to the solution whatever, so we might state that the solution was commercially pure. The reflectors plated in this special solution were no better than the ones plated in solutions that were known to contain at least fifty per cent. of inert material, such as potassium and sodium carbonates and potassium and sodium chlorides due to the use of mixed cyanides and silver chloride. This test would prove that the theories advanced by the learned writers were not or could not be a solution of the problem and that the true cause of spotting out was due to porosity and the occluded solution of potassium cyanides and carbonates held therein, which, due to their deliquescent properties, absorb moisture very rapidly in a damp atmosphere. Moisture then is an accelerating agent and would prove to be the true cause of the trouble, otherwise, as noted, the difficulty would be continuous throughout the year instead of during the hot humid season of the summer.

Various methods and remedies have been suggested to overcome the difficulty. One of the principal ones is to heat the articles to 220 degrees in a closed retort, thereby drying out all material in the pores of the metal. Yet when we consider that this temperature would only absorb the moisture and leave the solids still in the pores, we can readily understand why, after this treatment, under the influence of moisture the spots occurred just the same. The reason for this is that the absorbent properties of the potassium salts were not destroyed, and even months after, when the articles are exposed to a humid atmosphere, spotting out occurs almost as readily as a freshly plated article. The other methods prescribed are heating in sea sand or sawdust to the boiling temperature and numerous other methods, all aiming to accomplish one thing, and that is, drying out the solids and solvents by heat.

The writer believes that practically the only simple and satisfactory method of overcoming the trouble is by expansion and contraction of the surface, by immersion in absolutely boiling water and as cold water as possible. If necessary, the cold water can be maintained at a low temperature by some freezing method such as the ammonia process, etc. The coils carrying the freezing mixture could be immersed in the water and the cold temperature maintained. After plating, the articles should be washed in cold water as usual and then some mechanical arrangement devised whereby the articles could be immersed continuously for at least twelve immersions; first in the extreme cold water, then in the boiling water. By this means the solids become diluted by the waters and then by expansion, due to the temperature of the boiling water, the pin holes or pores become enlarged and absorb more water. Thus the solution becomes more dilute in the pores, and the rapid immersion in the extreme cold water causes contraction of the metal surface, consequently by compression the solution is ex-

*THE METAL INDUSTRY, November and December, 1913.

truded. If this is done constantly for a number of times, as stated, eventually nothing but water would be left in the pores which could be evaporated by the drying out temperature. Thus the spotting out problem, due to potassium salts, would possibly be overcome and the nightmare of years be replaced by summer nights' dreams instead of restless nights and weary days of the past, when heat and moisture held the plater in its unrelieving grip.

As a protective agent to the finished product produced in the winter months and held in stock, a stock room that can be kept entirely free from moisture and day light should be arranged and heated with steam coils continuously at a temperature of 120 degrees. The reflectors may be kept in such a room for years and will never spot out. The writer used such a room for years as a store room when in the employ of the Ansonia Brass and Copper Company's lamp department years ago.

The manufacturers of breakfast cereals have learned that their products, which rapidly absorb moisture in the summer time and become almost unsalable and unpleasing to the palate when eating, can be protected from atmospheric moisture by encasing the package on the outside with paraffin wax paper. If this simple remedy will protect cereals from moisture the writer is of the opinion that silver plated reflectors or other articles subject to spotting-out may be in a like manner protected at a slight cost.

WIRING A PLATING-ROOM FOR A DOUBLE VOLT DYNAMO—THREE WIRE SYSTEM

Some Valuable Hints for Wiring for the Plating Room.

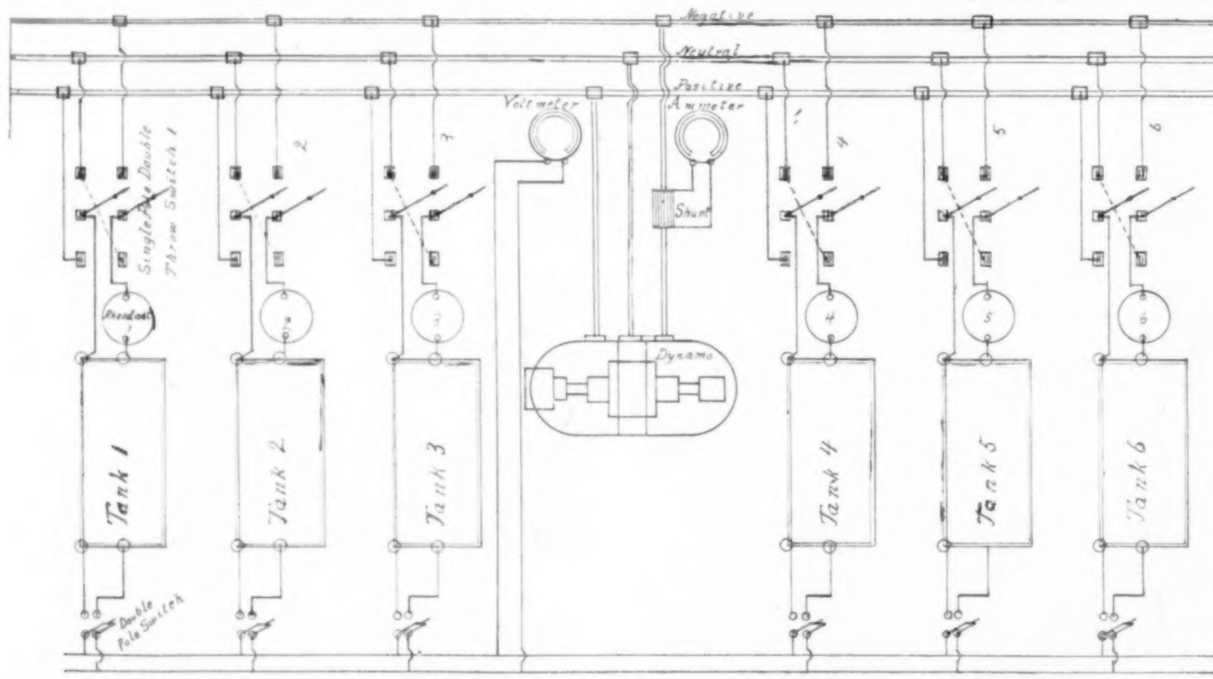
By H. J. Ter Doest.*

The accompanying diagram shows a method of wiring, which is at once the most flexible and easy to operate, as the readings can be obtained directly from the tank; so if any adjustment is necessary it can be done without leaving the tank and only one ammeter need be used as can be seen.

The diagram shows two single-pole, double throw-knife switches connecting the main circuit to the tanks. When both are closed in the up position it will connect that tank to the neutral (positive) and negative wire of the circuit, and the one from which the ammeter can be read, and if both switches are closed on the down position it will connect the tank to the positive and neutral (negative) side of the circuit, both of which are low voltage or one side of the dynamo. But if the left switch is down and the right switch is up, the tank is connected to the high voltage or both sides of the dynamo in series which is also readable on the ammeter.

It will readily be understood that if it is wished to get a reading on the ammeter and also wished to run the tank on the down side of the switch, all that is necessary is to simply place the switch up for the reading and then down again. By this method it is possible, by simply moving the switches, to place the tank on any part of the circuit, for if it should be desired some time to try higher voltage it simply means to throw the switch in its proper place. The dotted lines on the drawing show where the upper end of the left switch and the lower end of the right switch are connected together.

Now the voltmeter wiring is what I wish to call particular attention to. It is placed on the other end of the tanks in the diagram simply to make it plain, as it should be connected at the tank terminals on the other end with other wiring. It is very simple, just run two wires from the voltmeter to the tanks where it is wished to make a reading, to a double pole switch and to the top terminals of same switch connect the tank and by closing switch a reading can be obtained. All switches must be left open at all other times.



SHOWING THE WIRING ARRANGEMENT OF A DOUBLE VOLT DYNAMO—THREE-WIRE SYSTEM.

*Foreman plater, Enterprise Manufacturing Company, Akron, Ohio.

KNOWLEDGE

An Address Prepared for the Convention of the American Electro-Platers' Society at Chicago, Ill., June, 1914, but Which Was Not Delivered.

By Frank P. Davis.*

Wherever you see the heading American Electroplaters' Society, you see immediately under it the words "An Educational Society." The principle behind the formation of the A. E. S. was the dissemination of knowledge and the principal reason that the A. E. S. has endured and grown strong is because it has constantly kept that principle paramount. We hold that any knowledge that may benefit the plater is desirable whether it be the so-called trade secrets or knowledge that may effect his well being. So I have taken knowledge as the subject of my remarks to you, its desirability, and suggestions of ways to obtain it.

Many platers are graduates from the University of "H. K.," that famous institution of such tremendous roll that is popularly supposed to charge no entrance or attendance fees, but which in reality exact such a pitiless toll of one's life blood. During my term and my "P. G." course I picked up a few maxims and I have accumulated, wherever opportunity offered, precepts that to me seem to be fundamentals. They have stimulated me, and it is with the hope that they may, by chance, be of use to others that prompts this effort. It has been written that a man who will study one thing, however insignificant, until he knows more about it than any one else has solved his future. Please keep this thought in mind as I proceed:

No man ever got very far—and stayed there—who did not spend a vast amount of brain-sweat, who did not think things out for himself, who did not try to map out his own course, to steer his own ship, who cannot bear disappointment and say, if necessary, "My head is bloody but unbowed."

It is well said that knowledge is power, but truth is knowledge and this brings me to Thomas Huxley and his famous dream, the influence of which abided with him to the end. He had a dream, and in the dream he saw himself dedicated to truth. A stern yet kindly voice said to him, "Thomas Huxley, you are to maintain your intellectual honesty and self-respect; and no matter what comes, you are never to lend yourself to the cause that does not seem to you to be backed by the evidence of facts."

To the voice he answered: "While I live my motto shall be, truth for truth's own sake. I will regard the value of authority as being neither greater nor less than what it can prove itself to be worth. I will smite all humbugs, however big. I will tolerate everything but lying." And he kept his word. If there is any man who needs to know the truth it is a plater, the successful accomplishment of all his work depends upon truth and knowledge of all that enters into the make-up of his solutions.

There are men who claim that "bull" is as good as brains and that nerve is worth more than knowledge. A man without nerve in a crisis is useless, but played as a continuous performance nerve loses its charm. It is to be admitted that nerve has won many a jackpot, but there is no strain on the mind of the man who holds four aces. Circumstances call us all occasionally and knowledge is four aces in the game of life. Specialize on some one thing that you take the most interest in and study it from every angle, know more about it than any one else. It may be black nickel, or corrosion bronze colors. Whatever it may be, never forget it. Become a crank on the subject; a crank, by the way, is usually a man with original ideas. He is apt to know more of the subject he is "nutty" on than anyone else. Others may nickname him according to his specialty, but they will hunt him cheerfully when they need information.

*Celluloid Zapon Lacquer Company, New York.

Knowledge is education, and it makes no particular difference where you get it, once you obtain it you are educated. There is only one thing equal to knowing what you want, and that is knowing how to get it. A man with a college education and but a superficial knowledge of plating is a poor plater compared with a man of common school education and a deep and abiding love for the vocation he has selected for his life work.

How many platers know how nickel salts and similar chemicals are made? I do not mean what they are made of or the proportions of what they contain, but *how* they are made. One may say that such things are not at all necessary, but I maintain that a plater sufficiently interested in his calling to know these side lights is a better plater in consequence.

It is only the cheapest kind of a cheap fellow that will attempt to take credit for work accomplished by another, so never appropriate another man's idea without giving it twenty-four hours consideration. If nothing better occurs to you it is probable that Heaven meant to compensate you for your lack of originality by giving you the ability to recognize a good thing when you see it.

Never speak of being down and out except in the past tense; that is, when you are up again and remember that no one can come back who has never been anywhere; and *never* forget that on all God's green earth there is not one first-class substitute for knowledge. Cultivate an understanding of and an appreciation for, and a fair valuation of quality. It will give you stability and a sense of proportion as nothing else will, and refine your saving grace of common sense. Don't be afraid to say that you don't know occasionally. It is probably the truth, and it will create respect for your positive statements.

The wise guy who is always there with the ready answer is often measured up more promptly and accurately than he thinks, for the opinions of a man who has a positive notion on every subject mentioned are of no value, and there are those cold, cynical bosses who have learned that though calves may come and cows may go, bull goes on forever, and that an extra allotment of brains is rarely the cause of a swelled head, paradoxical as it may sound. These I have found to be good formulae, but like all platers' formulae, if they are to be useful, each must adapt them to his peculiar requirements, for in all walks of life everything is up to "the man behind." I will close with a few quotations on the subject, applicable to platers' lives and work.

"Knowledge is power."—Bacon.

"The first step to knowledge is to know that we are ignorant."—Cecil.

"The most difficult thing in life is to know yourself."—Thales.

"Man know thyself! All wisdom centers there."—Young.

"Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it."—Johnson.

"We know what we are, but know not what we may be."—Shakespeare.

"What can we reason, but from what we know?"—Pope.

SOME CONSIDERATIONS AFFECTING SPECIFICATIONS FOR WROUGHT NON-FERROUS MATERIALS*

SOME REASONS WHY IT IS DIFFICULT TO FORMULATE RIGID AND INELASTIC LIMITS TO SPECIFICATIONS.

BY WILLIAM REUBEN WEBSTER.†

INTRODUCTORY.

It is the purpose of this paper to enumerate and discuss some of the factors which affect the construction of specifications for wrought non-ferrous materials. While the use of these products in construction is large and important, the variety of uses is so extensive that with some exceptions not many data are available to the engineer desirous of defining his necessities.

Attention will be particularly confined to the copper-zinc alloys as representing the most comprehensive group of materials that are fabricated by wrought processes into sheets and strips, rods and bars, brazed and seamless tubes, and wire.

PROPERTIES OF COPPER-ZINC ALLOYS.

Copper and zinc alloy to form malleable and ductile materials in all proportions from about 55 per cent. up to pure copper, and over this range the products exhibit a normal variation of physical properties which is very great. Moreover, the properties normal to any particular proportion of the two constituents can be greatly modified by the processes of cold working and heat treatment. Other modifications are produced by the presence, either accidental or intentional, of other elements, more particularly lead, iron and tin. The effects of these vary in turn with the percentage of copper present and may be harmful or beneficial according to the purpose for which the material is required. Lead causes it to work freely under a tool but decreases ductility, the latter

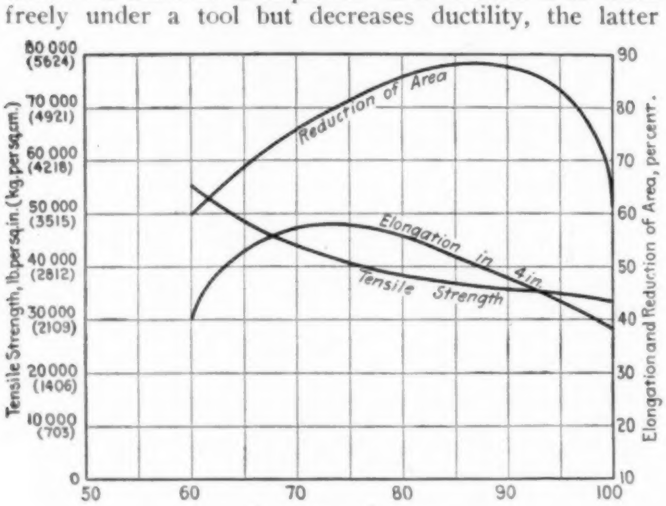


FIG. 1. CURVES SHOWING VARIATION IN PHYSICAL PROPERTIES OF COLD-ROLLED AND ANNEALED COPPER-ZINC ALLOYS, DUE TO VARYING PERCENTAGES OF COPPER AND ZINC.

effect in turn becoming more pronounced with decreasing percentages of zinc. Tin, on the other hand, decreases ductility greatly in the presence of considerable percentages of zinc. It is this very wide range of properties which can be imparted to the copper alloys in the wrought form, together with their non-corrodibility, which gives them the great value which they possess. At the same time, formulas have not been deduced which will accurately correlate components and properties to uses, although experience has determined with more or less correctness those things which should be avoided when any known purpose is to be met. Fig. 1 shows the variation in physical properties with the proportion of copper and zinc when cold rolled and annealed.

It is general practice to produce the alloys by melting the constituents in crucibles containing about 200 pounds, so that this quantity represents the unit heat. To determine all the important constituents of the product of each crucible charge is manifestly commercially impracticable, so the range of tolerable variations as determined by individual analysis must of necessity be comparatively large.

VARIATIONS IN COMPOSITION.

Departures from a desired composition as influenced by variation in the copper are not difficult to control, because ingot copper is produced in large furnace charges, permitting of accurate sampling and determination. Such, however, is not the case with zinc, each plate of which (about 40 pounds) not only shows an individual lead content of its own, but on account of the fact that lead and zinc do not alloy, will show widely different proportions in various parts of the same plate. Moreover, zinc is highly volatile, so a certain proportion of it is lost during the alloying process. This amount is difficult to control within close limits. It is governed by the proportion of zinc in the charge, the temperature of the crucible contents at the time the zinc is introduced, and the time elapsing between the introduction of the latter and the pouring of the crucible contents. It is evident also that some variation is due to the limit of error in weighing the charge, and that the large number of individual weighings necessary in producing any considerable quantity of brass affords an opportunity for occasional error. More or less variation also occurs in different parts of the same bar. As a result of all these opportunities for variation, the departure which any individual bar or ingot may show from the desired composition is considerable, its limit being the sum of all the variations due to each of the causes enumerated.

In addition the errors of chemical analysis need consideration. The Bureau of Standards recently prepared an accurate sample of sheet brass and made a careful determination of its constituents. Portions of this sample were sent to eleven different chemists accustomed to this class of work for check analyses. The extreme variations reported to the bureau showed for copper 0.15 per cent. of the total copper as determined by the bureau, for zinc 0.89 per cent., for lead 5.2 per cent., for iron 13.8 per cent. and for tin 10.2 per cent. It should be borne in mind that these determinations were made under conditions conducive to much more than commercial accuracy.

Three qualities of copper are ordinarily employed, namely, lake, electrolytic and arsenical. The differences in the resulting product due to the employment of any one of these three grades is not definitely established. In the early days of the industry, electrolytic copper was liable to contamination, but such a condition no longer exists. Several grades of spelter are in general use, the difference being due primarily to the lead content.

It is customary to make up the mixtures with certain proportions of scrap. The term scrap as here employed is not at all synonymous with junk. Good practice toler-

*Paper read at seventeenth annual meeting American Society for Testing Materials, at Atlantic City, June 30-July 3, 1914.

†General Superintendent, Bridgeport Brass Company, Bridgeport, Conn.

ates scrap only with a known history and of known composition. Properly safeguarded in this respect, the use of scrap is advantageous. It is much more difficult to produce a thoroughly homogeneous mixture when the entire charge is composed of unalloyed copper and spelter.

INFLUENCE OF THE CASTING PROCESS.

The casting process, besides being the cause of variations in the composition of the finished product, affords other opportunities for variation in the quality. When properly performed, the bar, billet or ingot should be free from blowholes, gas cavities or dirt in the interior, and from cold-shot or other surface imperfections on the exterior. Improper or unskilled casting profoundly affects the strength and ductility of the ingot.

The surface of molten brass becomes instantly covered with a thick film of oxide on exposure to the air, and this oxide must be prevented from becoming incorporated in the solidified metal. Two instances will illustrate the importance of proper casting. Ingot copper of the finest character, as received from the refining furnace, is neither very ductile nor malleable when cold, but when properly melted and cast from a crucible, it becomes highly so. A properly cast billet should show no pipe at the upper end, and when improperly cast a considerable pipe may occur. Fig. 2 shows a section of the upper part of a billet properly cast, and Fig. 3 of one improperly

FIG. 2. SECTION OF A PROPERLY CAST BRASS BILLET.

cast. The cut across the top of the billet in Fig. 2 shows the portion ordinarily discarded.

The crucible charge is cast into several different forms according to the use for which it is intended. If for sheet brass or strip, it is cast into bars usually about 1 inch thick and of a width varying from 4 to 14 inches, according to the width of the sheet required. The length is such that the standard crucible charge will make two bars. Wider sheets are produced by rolling the bars crosswise in the rolls until the required width is reached, or by cutting a partially rolled bar into lengths of approximately the required width and cross rolling to the finished thickness, according to the practice generally followed in rolling sheet steel.

Mixtures which admit of hot rolling are cast usually of greater cross-section, and of varying weight according to requirements. The extrusion process employs a billet 6 inches or more in diameter, weighing 150 pounds or more, according to the power of the machine employed.

OPERATIONS EMPLOYED IN MAKING SHEET AND STRIP.

Considering first the bar intended for sheet or strip, the various operations affecting the finished product will be discussed. After being cast, the bars have their gates or shrinkheads cut off. At the same time, the cut and exterior surfaces are carefully scrutinized for evidences of improper casting, and should any be found, the unsatisfactory bars are cut up to be recast. From the shears, the bars are then placed in an annealing furnace, heated to redness, withdrawn from the furnace and allowed to cool. They are then given several passes through the breaking-down rolls, being reduced 40 to 50 per cent. in

FIG. 3. SECTION OF AN IMPROPERLY CAST BRASS BILLET.

thickness. After breaking down, they are again annealed and overhauled. This last operation consists in scraping or cutting the surface of the bar with a reciprocating or rotary tool for the purpose of removing surface defects. This process affords opportunity for an efficient inspection, any defects in the casting being readily observable.

Rolling and annealing operations now alternate until the material is reduced to the desired thickness. The former operation increases the tensile strength, elastic limit and hardness, while reducing the elongation and reduction of area. Annealing removes the effect of rolling. This latter statement is subject to some modification in that the annealed cast bar has not quite the same physical qualities as after rolling and annealing. The effect of annealing is proportional to the temperature to which the metal is subjected. Characteristic curves showing the effect of cold rolling and of annealing are given in Figs. 4 and 5. Different mixtures give widely different curves.

Before the material is taken to the finishing rolls, it is pickled in a weak sulfuric-acid solution, which removes the oxidation and discoloration due to the annealing process, after which it is rinsed in water. The action of the pickle is not complete in that certain irregular surface discolorations or stains frequently remain.

The final rolling process determines the finished thickness or gage and also the temper, both of which are subject to considerable variations from that desired. Strips of metal after passing through a rolling process will show

two variations in thickness; one is a variation from side to side or across the width of the strip, the other from strip to strip or sometimes from one end of the strip to the other. The former variation differs in extent for different widths, thicknesses and tempers, and cannot be entirely eliminated. It is, however, quite constant in any individual lot. The latter variation is due mainly to variations in hardness and thickness of the strip before passing through the rolls. This variation may be due to differences in composition or differences in degree of annealing. When a strip is passing through a set of rolls, the stress tending to separate the rolls is so great that a considerable amount of elastic deflection takes place not only in the rolls, but also in the housings. This deflection is proportional to the stress, which is in turn proportional to the initial hardness and thickness of the metal.

It is the final rolling also which determines the temper of the material, this depending upon the amount of rolling given it after the final annealing. Fig. 4 indicates

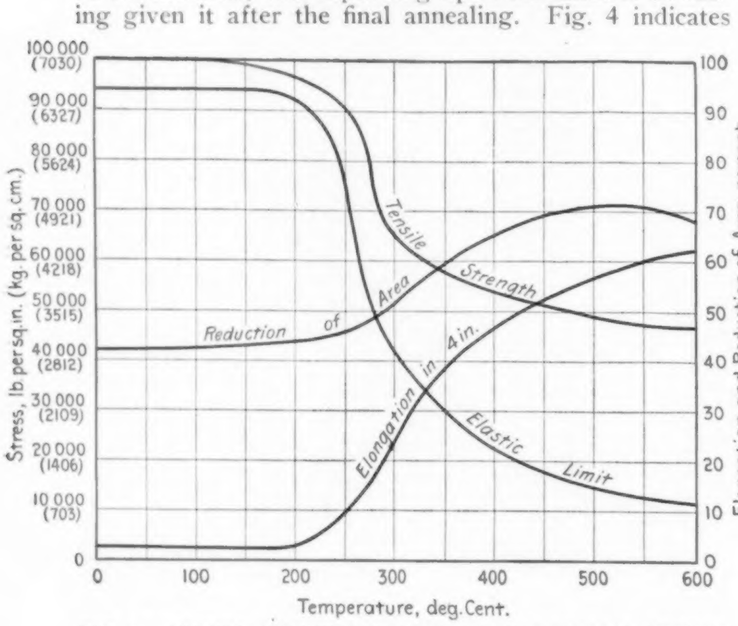


FIG. 4. CURVES SHOWING VARIATION IN PHYSICAL PROPERTIES DUE TO ANNEALING HARD-ROLLED BRASS AT VARYING TEMPERATURES.[1]

the wide range of properties due to variation in the amount of temper, and also shows the influences which the variation just discussed will have upon it.

A third quality due to the final rolling is flatness or freedom from buckles, more particularly in cases finishing with a temper. Subsequent flattening operations can more or less completely remove such buckles. All of the above variations can be modified by skillful rolling but cannot be entirely prevented.

Following rolling, the material if required with a temper is ready for the finishing operations. If required to be soft, it is annealed, pickled, washed and dried out, the last operation being, as its name implies, for the purpose of quickly removing the rinsing water to prevent tarnishing. The strip is now ready to be cut to width and length. The former is done by passing the strip between rotary shears or slitters, which may merely remove the edges so as to produce a uniform width, or may cut it into a number of narrow strips. Because of the variations of thickness across the strip above referred to, the strips cut from the edges will always be thinner than those nearer the center. Another variation becomes apparent at this point, namely, a variation in longitudinal straightness. One cause of this is due to failure to roll the strip straight caused by unequal reduction of its two sides. In addition, when a strip is finished with a temper, even though it is straight as rolled, it may, if slit into a number of strips, become longitudinally curved due to unequal tension between the center and side elements. In the slitting operation, the strip is usually handled and shipped in a coil if not too thick, but may be required to be cut to some specific length and shipped flat. This usually produces a certain percentage of pieces of unequal length, which percentage increases inversely as the number of lengths which the original strip will make. If the net length of the strip is 20 feet and is required in 8-ft. lengths, two of the latter and one 4-ft. length will be produced.

TEMPER.

Alloys in sheet form will divide into two groups, those which are required soft or annealed and those having a temper. The former are usually for uses which involve distortion, producing flow of the material, and the qualities requisite for highest suitability vary somewhat with the method by which this flow is accomplished. Properties which permit the maximum amount of stretch will not necessarily equally admit of change of shape involving flow between supporting surfaces, as in drawing

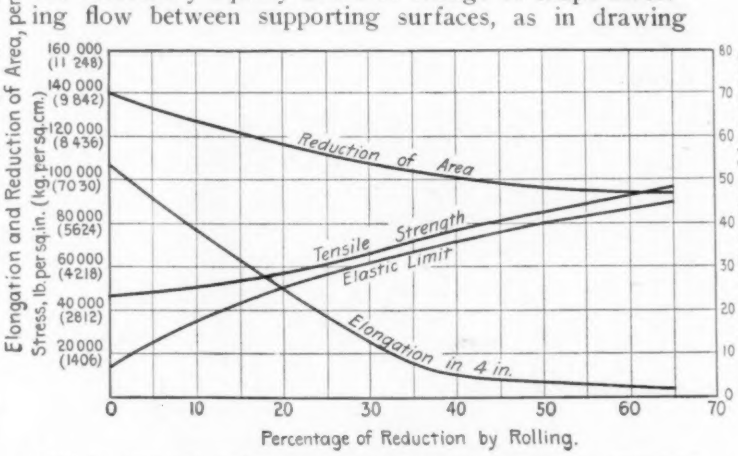


FIG. 5. CURVES SHOWING VARIATION IN PHYSICAL PROPERTIES OF ROLLED SHEET BRASS, DUE TO VARYING AMOUNTS OF COLD ROLLING.

operations. Again, a condition permitting of maximum stretch due to complete annealing may result in a roughening of the surface due to large crystal structure, which will materially interfere with subsequent polishing operations. With tempered brass, stiffness is the chief requisite, modified by ability to meet lesser amounts of distortion.

CLASSIFICATION OF KIND AND QUALITY.

Practice and trade usage have classified the copper-zinc alloys in sheet form into a number of groups according to the percentage of copper, the quality of spelter employed, and the added lead content. Several grades of temper are also recognized. The well-nigh universal test of quality, however, is the pragmatic test, the ability to meet the specific need of the user. These needs are arrived at by purely tentative methods and are satisfied by considering them in the light of experience. Attempts to quantitatively define needs, and to predict their satisfaction in terms of measurement, have not as yet been either numerous or highly successful.

DETERMINATION OF REJECTION LIMITS.

It is manifest that in such attempts difficulty will be encountered in establishing rejection limits, because of the number of variables governing the various factors.

[1]At the time the tests were made from which these curves were plotted no accurate means of temperature measurement was available. The temperature scale is therefore presented as only approximate.

The possibility of concurrent variations in a number of cases demands quite wide limits. Moreover, since each crucible charge constitutes a heat or lot, consideration must be given to the fact that no method of obtaining a single sample representative of anything other than the crucible charge from which it is drawn is possible.

As previously stated, rods may be made by the extrusion process, by hot or cold rolling, and by drawing. The first three are usually roughing processes although all are extensively employed as final processes.

MANUFACTURE OF RODS AND BARS.

In the extrusion process, the cast billet is heated to redness and forced hot through a die. The resulting rod or bar may then require only to be cut to length, but is frequently subsequently drawn cold through a die in order to bring it more accurately to dimensions, give it a temper and improve its finish. When the required section is relatively heavy each billet produces one continuous length; but with smaller sections, two or more are made simultaneously. This process is applicable only to those mixtures which are readily extrudable and is particularly effective in producing rods of irregular or difficult profiles.

More or less departure from specified cross-sectional dimensions occurs, which may be partially corrected by subsequent cold drawing. Variations in length must be permitted if the entire billet is to be utilized. The physical properties of the product of the extrusion machine are dependent upon the mixture employed, but vary somewhat with the temperature of the material at the time it passes through the die. Cold drawing modifies these properties similarly to cold rolling.

Extruded bars may be used for structural purposes, in which case the standard tension test furnishes a measure of the quality. The stress-deformation diagram is however of such a character as to make the location of the elastic limit or yield point a matter of some refinement. They may also be used for forging stock, in which case workability becomes a factor of importance. The process is also extensively employed for making rods for use in screw machines (turret lathes). For this purpose, the ability to cut freely is essential and is governed by the mixture employed. Accuracy of dimensions, straightness, soundness, homogeneity and freedom from imperfections are also required. The rod is extruded slightly larger than the required size, cold drawn, straightened, and cut to length.

Some mixtures cannot be either hot-rolled or readily extruded and must be cold-rolled or drawn. Usually the initial work is done by rolling and the final by drawing.

MANUFACTURE OF WIRE.

Wire is drawn from rods which may be either hot-, rolled, cold-rolled, or extruded, and afterwards drawn through dies by means of rotating blocks until the finished size is reached. The effect of cold drawing is similar to cold rolling so that annealing is required at intervals. Small sizes of rod are produced by straightening wire.

Variations in the characteristics of wire are produced precisely as in the case of sheet by variations in mixture, amount of hard drawing, and degree of annealing. No difficulty is experienced in keeping the diameter of wire within fairly close limits, as suitably made dies do not wear with great rapidity.

MANUFACTURE OF SEAMLESS TUBES.

Seamless tubes are made by cold drawing from hollow cylindrical castings, by cold cupping from circular blanks and by modifications of the Mannesmann hot-rolling process. The latter method is employed to produce a hollow blank which is reduced to size by cold drawing. There are numerous advantages and limitations possessed by the various methods. The primary requirement for a good tube is a sound casting. The most difficult factor to contend with is that of concentricity of the inside and outside surfaces. This is subject to relatively large variations even within the same length, although the inside and outside diameters can be closely controlled.

Seamless tube is not usually employed for purposes requiring much distortion, that incident to bending being usually the most severe. Certain limitations to the degree of temper which it can possess, however, exist in a tendency possessed by hard tubes to crack spontaneously due to internal stress. Seamless tubes are used largely for purposes involving exposure to the action of corrosive agencies such as sea water, and under such circumstances exhibit the erratic behavior shown by other materials under like exposure. Much difference of opinion exists as to the ability to resist corrosion, or lack of it, imparted by variations in percentages of copper and zinc, and other ingredients usually accompanying these, as well as to the results of various manufacturing methods and processes.

THE RELATION OF QUALITIES TO USES.

From the considerations above discussed, it will be seen that the problem of preparing rational specifications for wrought non-ferrous materials in various forms, and for various uses, is one involving many complex factors. It requires a comprehensive knowledge expressed in terms susceptible of definition and measurement of the qualities, which for any particular use are, on the one hand, necessary or desirable and, on the other hand, attainable. For example, it is possible to limit the presence of lead and iron always found in brass to quite low limits, and for certain purposes such limits are quite essential. There exists, however, a wide variety of uses which, to be most efficiently met, demand the presence of lead in varying amounts, while there are still other uses wherein it is neither beneficial nor harmful. Similarly, iron in considerable amounts may be advantageous, detrimental, or merely innocuous, according to the employment contemplated.

THE CONTROL OF QUALITY.

The difficulty of properly controlling the quality of material made in such small lots as to render impracticable the employment of suitable tests, physical or chemical, for each lot is however largely surmountable by the employment of appropriate mill practice and inspection. The test of manufacture is, in the case of cold-rolled or drawn material, capable of being made most severe. It has the exceedingly great advantage of application to an entire quantity, and not merely to a sample. No test of ductility, for example, can be more complete than that of drawing through a die, when the draft is properly chosen with respect to the ultimate ductility of the material operated upon.

CHILEAN EXPORTS.

The exports to the United States during 1913 as invoiced at the American consulates and agencies in Chile were valued at $38,386,959, an increase of $7,530,578 over 1912 and $26,612,390 over 1911.

There was a market increase in the exports of copper bars and ore to the United States, which will doubtless increase materially during 1914. There was also an increase of $6,806,592 in the exports of nitrate of soda for the United States over 1912 and $20,441,581 over 1911. The exports declared for the American insular possessions during 1913 comprised $532,207 worth of nitrate of soda for Hawaii, compared with $743,825 worth in 1912.

THE SAND BLAST FROM THE USER'S VIEWPOINT *

An Exhaustive Treatise on the Use of the Sand Blast for Cleaning Purposes.

By H. D. Gates.†

While the sand blast had its origin in the foundry for the cleaning of castings, its many advantages for the cleaning or surfacing in all branches of metal working, plating and finishing has been so long and so fully demonstrated, even when conditions were far from securing best results, that it has to-day become a fixture. The manufacturing foundryman and the machine shop owner knows that a thoroughly sand blasted casting not only works faster in his machines, giving an increased output, but materially reduces tool expense to the end of a lower production cost. The sheet and structural works have

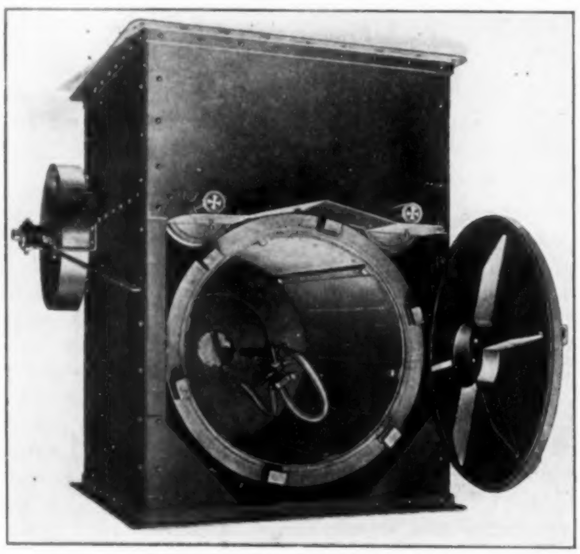


FIG. 1. SAND BLAST BARREL.

begun to appreciate its advantages, and the railroads are to-day practically unanimous in demanding the sand blasting of steel cars before painting, which not only gives a better surface for the paint to take hold of, with a correspondingly better finished job, but prevents inward corrosion which is vastly more important. Bridge builders are taking the same view, and Uncle Sam demanded that the gates of the Gatun Locks of the Panama Canal be sand blasted before painting, and is also cleaning the hulls of his ships, preparatory to painting and re-painting.

Makers of automobile bodies, in steel and aluminum, are surfacing them before painting. Forge shops are removing the scale to save their dies and to prevent the slipping of the metal under the dies. Metals to be plated, japanned, galvanized, sherardized, or treated with the various rust prevention processes such as Coslettizing, Bower-Barff, Carbonium, etc., are thoroughly cleaned preparatory to treatment, and many other varied lines of work are treated, down to small jewelry, which is given a satin finish all by various types and methods of sand blasting. Bar, rod or plate to be electrically welded is freed from scale and rust to assure perfect contact. Glass has long been frosted, lettered and decorated by the sand blast, and inquiry has been made for a machine to clean eggs, presumably after they had accumulated dirt and grime through long storage. Abrasives, paving materials, rubber and other products are tested for quality by sand blast methods.

We are all familiar with the cleaning of stone, brick and concrete buildings, and as it is used for roughing the handles of instruments to assure the surgeon a firm hold, for the surfacing of metal caskets and the lettering of grave stones, the sand blast may be said to be with us from the beginning to the end. Each of these various operations are of course individual to itself, but as the ultimate desired result in almost every instance is the same, that is, economy of production, it is obvious that along general broad lines its consideration to the work in hand must be the same. The advantages to the user and to the sand blast manufacturer while viewed from different angles must in both cases come from the same result; satisfactory operation to the end of profit. The sand blast machine or installation which does not in its results amply warrant the investment, is to the purchaser but an annoyance and expense, and to the manufacturer a black eye as a reference for future sales. With these conditions so apparent, the closest and most sincere co-operation between buyer and seller should be preliminary to any installation that is to prove of benefit to both.

This however seems to be far from the condition existing to-day, and is undoubtedly due as much to the negligence of the manufacturer as to the failure of the user to inform himself what return he can get from various systems and gauge his investment accordingly. There is no question but what there are to-day many sand blast machines and installations in use which are an expense to

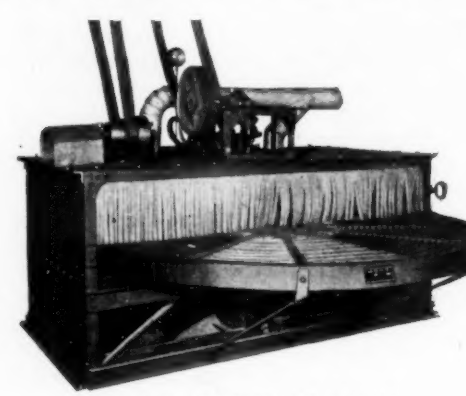


FIG. 2. REVOLVING TABLE.

the user, purchased in ignorance of the real adaptability of the selected process or equipment to the work in hand, and sold with a sole thought of immediate returns, to the prejudice and jeopardy of the manufacturer's business in the future. To reap the greatest benefit and advantage for both, therefore, the role of seller and buyer should be eliminated in the transaction, to be replaced by that of counsellor and client. This demands that the purchaser sink his general antipathy to the "Salesman," and give his co-operation as freely as he would to his doctor or lawyer, fully explaining the work and various conditions to be met, with any other details, full knowledge of which are so vital to the intelligent selection of a paying installation.

Let us assume for the minute that this millennium of trade conditions has been reached and see how we should go to work to accomplish the end that is so desired to our mutual advantage. To determine the type and size of the sand blast machine we must first consider the material to be cleaned. What will be the average shape, size and weight of the pieces and the daily volume? Is it generally plain surfaced, or intricate cored work? What is the

*Paper read at recent meeting of Associated Foundry Foremen, New York.

†Sales Manager, Sand Blast Department, De La Vergne Machine Company, New York.

range of weights from minimum to maximum? Is it stock work that runs very much alike at all times, or is it the general jobbing run that may vary largery from day to day? What percentage of the work will be small, that is quickest and cheapest cleaned in the sand blast barrel? What percentage is too large for barrel work? Is any portion of it of size and shape that economy would be found in cleaning it on a revolving or traveling table machine? or

Is it such a conglomeration of various sizes, weights and shapes that there is not enough of any particular kind to warrant the installing of either of these automatic machines, and that we must revert to the old stand-by, the Hose Type machine, that will clean anything and everything, although not always with the best economy? No intelligent consideration can be given the subject without this knowledge together with the volume and pressure of air available. If all other considerations than the character and valume of work could be eliminated, our selection of a type of machine would be reasonably simple, but as the sand blast is in every instance dependent on compressed air for its operation, this item must of course be considered in conjunction with the machine.

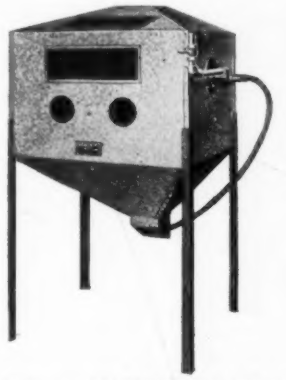


FIG. 3. CONTINUOUS FEED SAND BLAST CABINET.

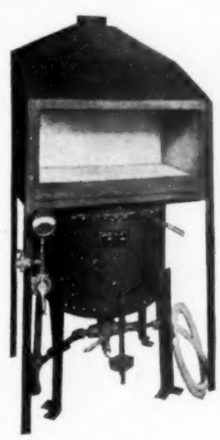


FIG. 4. COMBINED PRESSURE BLAST AND CABINET.

Has the plant already compressed air installed, and if so, what volume of free air per minute is available for sand blast uses? And to what pressure is it initially compressed? If we are limited in this way and compelled to meet conditions that cannot obtain the lowest cost per ton of cleaning, the why and wherefore should be thoroughly gone into, to determine whether a sufficient advantage in added economy can be definitely shown to warrant an investment in additional air equipment.

Assuming, however, for the moment, that the volume of the different classes of work are sufficient to warrant an automatic machine with its economy of handling and that the air volume available is sufficient for its operation, we have a selection of two types before us. For small work adapted by size and shape to cleaning in the sand blast barrel, there can be no question of the economy of this type of machine. (Fig. 1). The air volume required will of course be governed by the number and size of the nozzles and actual comparison of cleaning time with different size nozzles is the only way to determine the most economical for various classes of work. A single nozzle in larger size, of right design, construction and location, giving correct application of the sand stream to the work will be found more economical in air consumption and power cost than multiple nozzles of smaller sizes.

Pieces too large for successful barreling but that will still permit of automatic handling will be cleaned with least labor, on the round and reciprocating type table machines. (Fig. 2). If, however, the pieces are of such shape or design as to demand constant labor in turning them to bring all surfaces under the action of the nozzle, the question of economy under these conditions require the closest consideration before selecting this type of machine for varied work, although on certain classes of material, it is ideal. In many plants while the character of the work may be such as to be ideally handled by one of the different types of automatic machines, the daily volume may be so small as to entirely preclude the investment required in a machine of this type, and with this condition apparent, one of the small enclosed cabinets of the self-contained, continuous feed type (Fig. 3) with stationary or portable nozzle, as the character of the work may demand, offers at a very low first cost a practical and satisfactory sand blast equipment.

The combination pressure blast and cabinet, as illustrated (Fig. 4), also offers at small cost the most efficient equipment for small volume work of the most varied character, as the work can be accomplished in a practically closed cabinet, while the outfit is still available for heavier pieces on bench or floor work if desired. In machines of automatic operation, construction showing fewest parts and simple design with correspondingly least wear and fewest repairs, will mean longest life and should have careful attention beyond the mere cleaning results obtained.

It is safe to say that the varied character and limited output of the majority of plants including foundries, and the investment possible or warranted for sand blast equipment, demands a machine that will clean anything and everything, even though with a loss of economy on some portion of the output, and to meet this nothing has been presented to equal the Hose Type Machine shown in Fig. 5. The machine being designed to clean metal and displace sand, rust or scale, some of which has fused and become almost as hard as the metal itself, it is evident that to be efficient, the machine in addition to being available for any pressure, must resist the hardest service to be found in the foundry. Here, particularly, does the question of simplicity, few working parts giving a minimum of upkeep cost and with corresponding ease of operation, become paramount.

FIG. 5. HOSE TYPE PRESSURE BLAST.

To maintain a steady, constant flow of sand and assure the use of the entire machine load, a cone bottom of the right angle is necessary. Graceful lines maintained at the expense of false bottoms which can hardly be made sand tight, but provide a hiding place for dead sand, are of no value. Double tanks, internal mechanisms, supplementary valves and other construction which adds parts, and cannot increase efficiency, should be avoided. A simple sand valve to close air tight with air valve which brings the air in direct line to the opening of the hose, all in a single piece and easily removed, promise best service, maximum efficiency and longest life with least trouble. A dished head fitted with a screen will assure quickest filling with the elimination of funnels, pails and troublesome gaskets, caps and bails The size of the hose type machine itself should unlike the self-contained continuous-feed automatic machines be selected with reference to

the nozzle equipment to be used. As an illustration: Under 80 pounds pressure a 3/16 inch nozzle flows 48 cubic feet of free air per minute and discharges approximately 500 pounds of sand per hour. A ¼ inch nozzle flows 85 cubic feet of air and discharges approximately 900 pounds of sand per hour. A 5/16 inch nozzle, 133 cubic feet of air with approximately 1300 pounds of sand per hour discharged. A ⅜ inch nozzle, 191 cubic feet of air with approximately 1700 pounds of sand per hour. A ½ inch nozzle, 340 cubic feet of air with approximately 3000 pounds of sand per hour flowing. As economy will be obtained through the constant operation of the sand blast machine, it will be apparent that the less frequent refilling of the sand tank, if done by other than automatic means, will be desirable and it would hardly be advisable to select a machine that would give less than an hour constant operation and a sand storage capacity doubling this would pay in the end if the machine is to be hand-filled.

AIR VOLUME AND PRESSURE REQUIREMENTS.

Now with the type and size of the equipment for our individual needs determined, we are up to the question of air volume and pressure requirements. If the plant is without air, compressor equipment must be installed. Now, don't make the mistake of buying a compressor of sufficient size to barely meet immediate needs. Fully 90 per cent. of the foundries to-day are complaining of lack of compressed air volume, and this is due to the constant added demands which are made on the air plant once it is in operation. The greater first cost of an air compressor of large volume over the same type of small capacity is so comparatively slight, that the provision of ample air to permit use of proper equipment for cleaning at the lowest cost per ton, is undoubtedly advisable in the long run. Particularly is this so, as the cost of compression per cubic foot of free air to a given pressure is no greater with a large capacity machine than with the small, and the larger machine, to meet present needs, can be run at reduced speed to produce a lesser volume, with a corresponding reduction in horsepower. It is then available for increased demands when wanted, while it is not safe to run the small machine at a speed beyond its rated capacity.

CUBIC FEET OF FREE AIR PER MINUTE FLOWING THROUGH DIFFERNT SIZE NOZZLES AT VARIOUS PRESSURES WITH HORSE POWER DEVELOPED IN SINGLE STAGE COMPRESSION AT SEA LEVEL (WITH USUAL LOSSES).

Diameter of Nozzle Inches.			Pressure of Gauge in pounds per square inch.								
			20	30	40	50	60	70	80	90	100
....	....	1/8	* 7.70	10.00	12.30	14.50	16.80	19.00	21.20	23.50	25.73
....	....	..	† .63	1.03	1.50	1.99	2.57	3.19	3.86	4.51	5.33
5/32	....	..	* 12.04	15.72	19.17	22.68	26.22	29.71	33.20	36.44	42.50
....	....	..	† .99	1.62	2.34	3.11	4.01	4.99	6.04	7.00	8.80
....	3/16	..	* 17.10	22.50	27.50	32.80	37.50	43.00	47.50	52.50	57.88
....	....	..	† 1.40	2.32	3.26	4.49	5.74	7.22	8.65	10.08	11.98
7/32	....	..	* 23.77	30.81	37.58	44.44	51.37	58.24	65.08	71.43	78.80
....	....	..	† 1.95	3.17	4.58	6.09	7.86	9.78	11.84	13.71	16.31
....	....	1/4	* 30.80	40.00	49.10	58.20	67.	76.	85.	94.	103.
....	....	..	† 2.53	4.12	5.99	7.97	10.25	12.77	15.47	18.05	21.32
9/32	....	..	* 39.02	50.94	62.13	73.47	85.	96.	108.	118.	130.
....	....	..	† 3.20	5.25	7.58	10.07	13.00	16.13	19.66	22.66	26.91
....	5/16	..	* 48.17	62.89	76.70	90.70	105.	119.	133.	146.	161.
....	....	..	† 3.95	6.48	9.36	12.43	16.07	20.00	24.	28.03	33.32
11/32	....	..	* 58.29	75.10	92.81	109.85	127.	144.	161.	176	195.
....	....	..	† 4.78	7.74	11.32	15.05	19.43	24.19	29.30	33.79	40.57
....	....	3/8	* 96.	90.	110.	130.	151.	171.	191.	211.	232.
....	....	..	† 5.66	9.27	13.42	17.81	23.10	28.73	34.76	40.51	47.9
13/32	....	..	* 81.	106.	130.	153.	178.	201.	225.	246.	272.
....	....	..	† 6.64	10.92	15.86	20.96	27.23	33.77	40.95	47.23	56.30
....	7/16	..	* 94.	123.	150.	178.	206.	233.	260.	286.	315.
....	....	..	† 7.71	12.67	18.30	24.39	31.52	39.14	47.32	54.91	65.21
15/32	....	..	*108.	142.	173.	204.	236.	268.	299.	328.	362.
....	....	..	† 8.86	14.63	21.11	27.95	36.11	45.02	54.42	62.98	74.93
....	....	1/2	*123.	161.	196.	232.	268.	304.	340.	376	412.
....	....	..	† 10.09	16.58	23.91	31.78	41.00	51.07	61.88	72.19	85.28
....	9/16	..	*156.	204.	249.	294.	340.	385.	430.	472.	521.
....	....	..	† 12.79	21.01	30.38	40.28	52.02	64.68	78.26	90.52	107.85
....	....	5/8	*193.	252.	307.	364.	420.	476.	532.	587.	643.
....	....	..	† 15.83	25.96	37.45	49.87	64.26	79.97	96.82	112.70	133.10
....	11/16	..	*233.	304.	371.	439.	508.	575.	643.	706.	778.
....	....	..	† 19.11	31.31	45.26	60.14	77.72	96.60	117.03	135.55	161.05
....	....	3/4	*277.	362.	442.	522.	604.	685.	765.	843.	925.
....	....	..	† 22.91	37.29	51.48	71.51	92.41	115.08	139.23	161.86	191.48
5/14	....	7/8	*378.	493.	601.	710.	822.	930.	1004.	1145	1261.
....	....	..	† 31.00	50.78	73.32	97.27	125.77	146.56	182.73	219.64	261.03
....	....	1	*494.	645.	785.	930.	1070.	1215.	1360.	1500.	1647.
....	....	..	† 40.51	66.44	95.77	127.41	163.71	204.12	257.52	288.00	340.93

*Air. †Horse Power.

In any type of sand blast machine the air required which governs the power consumption will be determined by the size and number of nozzles used and the pressure maintained. The following table shows the air consumption through various size nozzles at different pressures with the horsepower developed, single stage compression (with allowance for the usual losses) at sea level, and gives at a glance some conception of the increase in air flow as the nozzle size is increased.

Undoubtedly the satisfactory working pressure is the most mooted question among sand blast manufacturers to-day, but there is one answer to this question on which all agree, and that is the pressure which will do the work

the cheapest, all other conditions to be met considered. To determine what this pressure is, we will have to come back to our first consideration of the material to be cleaned. If castings, is it gray iron, malleable annealed or unnealed, steel, or is it brass, bronze or aluminum? How thoroughly does the producer or customer demand it to be cleaned? What degree of care has it had in molding? How tenaciously does the sand stick? or To what extent is it fused with the casting? If it is sheet, plate, bar or rod, what is the thickness of scale, rust, etc.? What is to be the ultimate use of the finished piece?

If it is required but to remove the loose sand, a working pressure under 30 pounds will undoubtedly be satisfactory even on iron or steel, and would provide a surface suitable for painting. If, however, the pieces are to be machined, every particle of the fused sand which if the metal has been poured extremely hot, practically becomes a glass scale, should be taken off, to expose the pure metal to the action of a cutting tool, and on steel up to 90 pounds will be required for most economical cleaning. Exposure of the pure metal as indicated above will not only reduce materially tool expense, but in actual practice has demonstrated that an increased output of at least 15 per cent. is possible in the machine shop, and this is an item that should not be overlooked by the purchaser of castings as well as by manufacturing foundrymen or the jobbing foundrymen supplying castings to be machines, and who has an eye to creating a steady demand for his product. Pieces that are to be galvanized, sherardized, plated, japanned or enameled, must also be thoroughly freed from the fused sand and scale or rust.

To determine this most economical pressure there must be taken into consideration beside elements of labor and abrasive, the initial pressure to which the air is being delivered from the compressor. The majority of pneumatic equipment used to-day require 80 pounds pressure and in most instances, therefore, we find air being delivered to the receiver at this pressure. While it might be demonstrated that the castings could be most economically cleaned at a lower pressure if the air was initially compressed to this point (by reason of the lesser horsepower required), if other requirements in the plant demand a standard pressure of 80 pounds, sight must not be lost of the fact that every foot of air used for sand blast purposes which is reduced to the lower pressure is costing the same in horsepower as though it was used at the initial pressure of 80 pounds.

While, too, it is true that the volume of air at lower pressure would be less than at 80 pounds, calculation must be made on the basis of cost of initial pressure to determine which, under these conditions will be the cheaper, other factors entering into the cleaning being considered as well. There are few foundries other than those handling the largest output that will consider a double air plant system, one at higher pressure for other pneumatic equipment and low pressure for the sand blast operation, even with some constant saving in power cost. Unfortunately accurate cleaning costs which should embrace,

Compressed air power cost, labor, abrasive consumed, ventilating power cost, interest on investment and depreciation as well as saving to be effected in the grinding and chipping departments and the machine shop, are not kept in many plants or at least this has been the experience of the writer, and in considering this question of economical pressure, we are therefore compelled to rely on personal observation as opportunity offers and on theoretical tests which do not always approximate operating conditions. There can be no successful contradiction that on non-ferrous metals with other conditions right, the lower pressure u pto say 40 pounds will be found economy, as well as in certain classes of iron work, notably bathtub and other sanitary wear castings. Keeping in mind that in every instance the thoroughness of the cleaning must be a determining factor, efficiency of the various pressures can be determined by the results obtained under like conditions.

In the tests made by Professor Wm. T. Magruder, covered in a paper read before the American Society of Mechanical Engineers, his results in removing metal from a cast bar, show that the time required to remove one pound of iron at 20 pounds pressure was 3.55 hours; at 30 pounds, 2.77 hours; at 40 pounds, 2.13 hours; at 50 pounds, 1.52 hours; at 60 pounds, 1.07 hours, and at 70 pounds, .82 hours. The approximate correctness of these results are corroborated by general observation of various lines of work over a period of some years, and in one or two instances where extended tests under working conditions have been made. In one instance on steel castings with compressors carefully calibrated, it was shown that at 40 pounds pressure through a 9/16 inch nozzle, 230 cubic feet of free air per minute requiring 73 H. P. to develop, cleaned 120 pieces, weighing 200 pounds each in a 10 hour day.

With pressure at 80 pounds passing through a ½ inch nozzle flowing 140 cubic feet of free air per minute, 156 pieces were cleaned in 10 hours. In the first instance the air was compressed to 80 pounds, and passed through a reducing valve to the sand blast machine. Under these conditions the power saving operating with the higher pressure was enormous when considered annually. Had the air in the first instance been initially compressed to 40 pounds, the power saving would have been over 12 per cent. at the higher pressure, to say nothing of the greater output. The general proposition of the low pressure cleaning is volume of sand, which requires large hose and nozzle, consuming air at low pressure and cost, while the high pressure operation provides minimum of sand driven at highest velocity through small hose and small nozzle with high pressure and cost of air.

As a general conclusion, we agree with Prof. Magruder's contentions that the horsepower cost for the same results by either operation with the air initially compressed to the operating pressure is approximately the same, and that the determining factors will therefore be the volume of output with the minimum of labor. The abrasive to be used should be well considered in any sand blast installation. Here again we are hampered in reaching a definite conclusion through lack of accurate results in actual practice. In the automatic machines where the abrasive is confined and can be all preserved, the metal abrasive are undoubtedly more economical than sand.

Tests observed on castings show shot and grit to have approximately 60 times the life of sand. In an instance of use of grit with a hose machine, a steel foundry reports 3 tons loaded into the system and a loss of but 10 per cent. noted at the end of one month, while with sand used, the daily loss by disintegration was 25 per cent. This latter is undoubtedly excessive and may have been due to poor grade of sand. In this instance no advantage in rapidity of cleaning was apparent with the grit over sand. In another foundry the cleaning time required by sand was reduced 20 per cent. by using shot. This seems logical as the metal abrasives have 2½ times the specific gravity of sand.

In this plant, records kept for a period of six months showed with the same apparatus and conditions that 1 pound of shot was equal to about 20 pounds of fine silica sand. The pieces cleaned were steel weighing approximately 200 pounds, and the shot used was of a size that an average of 33.7 per cent. was retained on number 20 mesh screen and 66.3 per cent. retained on a number 40 screen. The experience in this plant was that the shot made a

great saving over sand as it did better work, eliminated necessity of large storage bins, the cost of handling and drying sand and by its own lesser disintegration created less dust, making better conditions for the operator. On the contrary in some experiments conducted with the metal abrasives on material to be electro-galvanized it was found that with equal power consumption perfect results were obtained with sand, while the metallic dust created by the metal abrasive adhered to the pieces and imperfect galvanizing resulted. On account of the high cost of metal abrasives, their use with hose type machines must be confined to systems that have tight rooms and provide automatic handling to present its loss. Thorough separation of dust and abrasive must be assured in the use of either for best efficiency, and the methods to obtain this adapted to the abrasive.

With the increasing use of sand blast equipment, it is becoming recognized that livable conditions for the sand blast operator with adequate ventilation, far from being philanthropic, are but a sound business policy, and hardly any consideration of sand blasting would be complete without touching the various systems to accomplish these ends. Sand blast rooms range from the simple enclosure with a solid floor from which the used sand can be shoveled for re-use, and ventilated with a wall fan, drawing the dust out of the room into the surrounding atmosphere, to systems which not only in their methods of ventilation prevent the rising of the dust to the operator's head, confinement of the dust with automatic handling, screening and cleaning of the abrasive material for re-use and automatic loading of the sand blast with little interruption of the sand blast operation, but in many instances provide automatic handling of the work itself, bringing it up to the operator under his control, and delivering it beyond to the chipping or grinding room.

The condition which will determine for the customer to what extent he will provide these devices, should begin with the cost per ton of cleaning with each, to determine the investment warranted, rather than, as we find the case, the first question being "what it is going to cost to install." Method of confining the dust and the degree to which this must be obtained will be governed by demands of geographical location to residence districts, other plants and machine shops, which would be annoyed by the created dust, and this question alone will cut some considerable figure in the cost of installation. Methods of handling and screening the sand, should be determined not only by the cost of power requirements but by the efficiency of separation demanded, and the kind of abrasive used.

Some idea may be obtained of the relative value of these installations from the fact that one steel concern by the installation of a plant providing adequate ventilation with the abrasive handled, screened and cleaned automatically, were able to increase the output of their sand blast from 15 tons in 10 hours to upwards of 18 tons in 5 hours, or over four-fold. Routing of the material and handling methods are other items that should not be overlooked. The experience of two concerns having identical equipment will be illuminating on the value of this item; one obtained an output of 35 tons per day, while the other complained of the inefficiency of equipment because they were turning out but 10 tons per day.

This condition was corrected through the co-operation of the manufacturer to secure proper handling, and is but an instance of the value he can and should be to the user to their mutual advantage. The purchaser in addition to giving the co-operation outlined above must be careful to first select a concern worthy of it. This means a manufacturer with an open mind, ability and desire to see the purchaser's side, and who is not confined by limitation of his line to the desire and even necessity of attempt to adapt it to every condition in order to make the sale. His organization must be more than mere "salesmen," and have the knowledge born of a long experience of actual practice. His resources and facilities not only should insure production of equipment at lowest cost consistent with quality, but his business life as well, to the end that you may always obtain the replacements, repairs and supplies necessary in sand blast operations.

Perhaps most to be desired he must have a firm conviction that other than an economical and satisfactory installation creates more loss by many times not only to his own individual business, but to the entire sand blast art, than the amount of any possible pecuniary profit to be gained from the sale. While you are looking up his standing along these lines you may be sure he is as carefully scrutinizing your ability to pay for the equipment. To the man who is already a user of the sand blast, if you are not getting satisfactory results, take it up at once with the manufacturer of your equipment and work with him to determine where the trouble lies and how to correct it. Before you holler, however, be sure that the conditions complained of are not within your own establishment. If you are operating a machine shop and install a lathe costing $300 or $400, you see that the tool has proper care and is not used by other than an experienced capable lathe hand. The chances are, however, that your sand blast is turned over to the cheapest and most ignorant laborer in your plant, with no intelligent supervision, and still you wonder why you don't get satisfactory returns from it.

A complaint from a user that his machine would not work, developed the trouble to be of his own making. A burned fine core sand was being used, which was largely dust, and this with the condensation of the moisture in the compressed air had formed a mud and caked an air inlet, a trouble that so far as the operation of the machine was concerned, was corrected in less than 5 minutes. When conditions were brought to this man's attention he was keen enough to see that, not only had the present trouble resulted, but that he had been constantly getting far from the efficiency he was entitled to, through his own negligence and the use of imperfect material.

If your own manufacturer cannot see his interests the best served in co-operation to give you the fullest advantages from his equipment, call on some one versed in sand blast practice, conditions and requirements, and if necessary retain them as you would an engineer or an architect. The services that such a man can render you will return the cost of his fee many times over. In other words, demand of the manufacturer all that you are entitled to, but do not overlook the fact that the sand blast equipment is entitled to the same care and consideration that you give your lathes, your boilers and your engine, and that the right kind of co-operation will make money for both the user and the manufacturer.

COPPER PRODUCTION IN RUSSIA.

The production of copper in the Caucasus in 1913 was 9,222 tons, as compared with 10,368 tons in 1912. One of the three companies is erecting a concentration plant, part of which was completed and in operation before the end of 1913. A new ropeway was also finished and other improvements were made. The company hopes to maintain production at 400 to 500 tons per month. A new plant was erected by another firm at its copper deposits at Kvartshana in the Province of Batum, and it is reported that considerable ore there is ready for treatment as soon as the blast furnace smelting works are completed.

THE MANUFACTURE OF LAMPS, CANDLESTICKS AND LANTERNS IN BYGONE DAYS

An Interesting Article Dealing With Early Day Methods of Lighting.

By Isabelle M. Archer.

The history of the metalworker's art is traceable in all its various stages through the several hundred lamps and candlesticks which, during many years of patient study and labor, Dr. Quincy Norton has gathered into his unique and comprehensive collection of ancient lighting utensils.

This collection was exhibited at the Merwin Galleries, New York City, during the past year, and at the subsequent sale, broken up and dispersed among new owners. As a whole, it has proved a means of studying, not alone these curious old relics, but the trades which made them possible, and the progress gained in metal working during the Age of Lamps and Candles.

The glowing embers of prehistoric man's camp fire was the first "artificial" light used for dispelling the darkness of the night; a flaming brand from out that fire was the first portable light—a torch; a bundle of fagots, carried in an iron brazier, was the first lantern; shells, scooped out stones, shallow clay dishes holding pitch, animal and vegetable fats, were the first lamps; moss, strips of bark and short rushes, were the first wicks; and these same wicks, dipped in the fat from the lamps, were the first candles. It is generally the candle that is spoken of with the greater reverence, but lamps were in use long before candles were known.

Clay lamps were used in early Phoenician times, and a Babylonian lamp has come down to our day. This precious example was among Dr. Norton's treasures. It is the prototype of those later lamps of Egypt, Greece and Rome, with its apertures for wick and filling and its bulbous, oval body only three inches in length.

The first metal lamp was of iron, annealed and hammered into shape. Before the iron that we know was mined these saucer-like lamps were formed from meteoric iron, a natural composition in which are found iron and zinc, with traces of other metallic matter. From this iron castings were first made: solid, clumsy forms from moulds of sand and clay; but not until many centuries later was our modern method of casting inaugurated. The Celtic ores, tin and copper from ancient "Casseterides" was used for the quaint little lamps, and the clever Greeks, by mixing the two metals, made the first bronze 400 B. C.

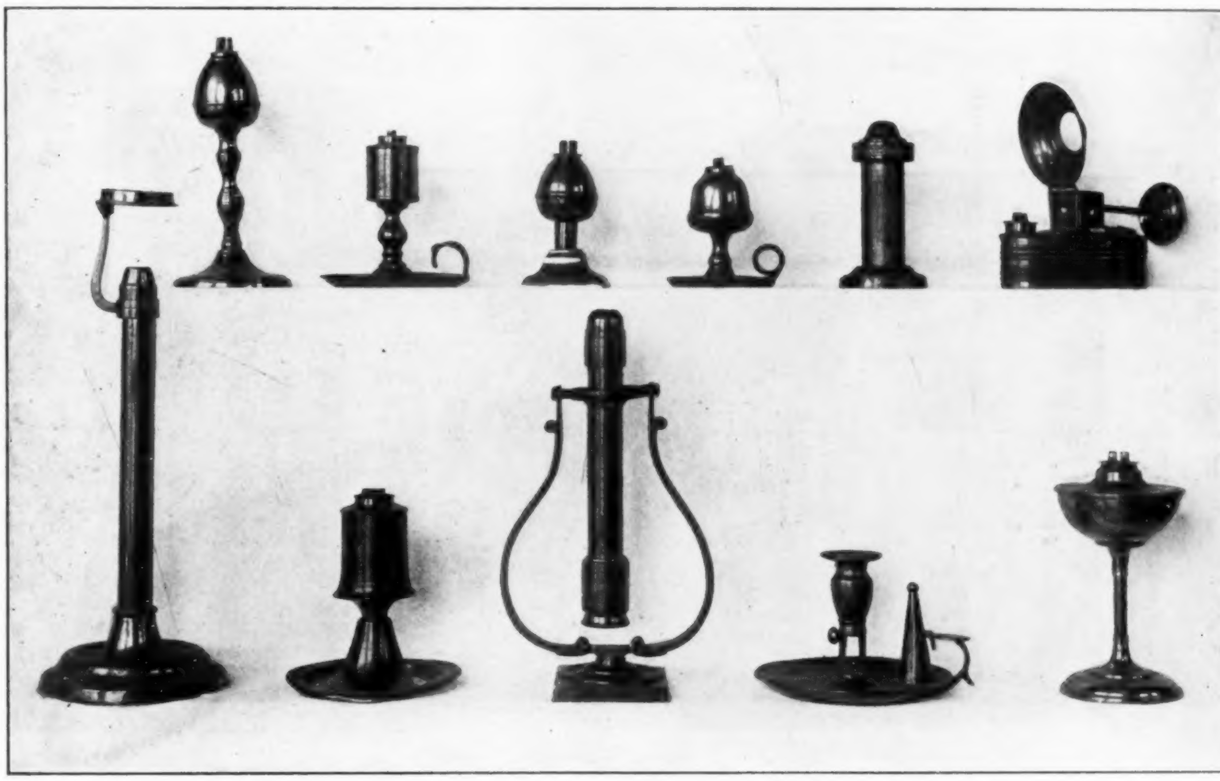


PLATE 1. 18TH CENTURY BRASS LAMPS AND MARINE CANDLESTICKS.

Samples of these early Greek bronzes were shown at the exhibition in the form of some beautifully decorated lamps, for the lamp was always, till its place was usurped in the 19th century, one of the most prized possessions of the thrifty housekeeper, and the newly found bronze would naturally be used in their making, and thoughtful care taken in their decorating. An improvement on the open, shallow dish was made with the closing over of the top of the lamp, and later a detachable cover and a handle were added. The material for the wick had changed, too; rushes, closely braided, and coarse materials woven from flax or hemp replaced the wool and bark wicks, and olive oil was burned instead of the animal fats which at first were used.

The renowned bronzes of the ancient Romans are represented by an exquisite little lamp, a predecessor of our so-called "standing" lamps. Raised on a slim stem above an oblong base, it is about three inches high, with the rounded oval body, typical of the low lamp shapes. An up-curved hook serves for the han-

dle, and it has a cleverly made hinged cover. Another Roman lamp of bronze that is extremely unique is decorated with the Christian symbols; a dove perched upon a well proportioned cross serves as its handle; another dove, in full relief, with spreading wings, decorates the tiny lid that closes the aperture for filling, and a seven pointed star surrounds the opening for the wick. Lamps having two or more wick holders were also made by the Roman craftsmen; and with each succeeding attempt at improvement the workmanship gains in delicacy and finish. A lamp for two wicks has the Roman standard for its upright handle, and a flat dish-like lamp that will give four little flames of light is well formed with a central font to hold the oil and four branching arms for the wicks.

It was from the Orient that the first candles and lanterns came. The Chinese still use their candle-lit lanterns, and long before the Christian Era these eastern methods of lighting had found their way through India, Persia and Arabia to Jerusalem, where the Jewish metal workers made splendid candlesticks and candelabra for use in their temples. The influence of Eastern workmanship is also shown in the candlesticks of Byzantine design from Russia, where they use elaborate candelabra and handsome candlesticks in their churches.

The renowned candlesticks of the Louis XIV. and Empire periods are a great step in advance of the primitive iron candleholders—two prongs stuck into a block of wood—from the North countries, Germany, Belgium, and Holland, yet both kinds were used simultaneously, and the most common kind for a very long time was the broad-based tin affair which had been copied from the old iron lamps. Many of these the early settlers of America brought with them from their former homes in England and Holland; but candles were difficult to get, as whale-oil and tallow were at a premium until the whaling trade had progressed and cattle were brought from Europe. Rushes and rags made candles and wicks for the earliest settlers, and lamps, candles and lanterns were all imported until the opening of the first rolling mills and foundries by the Colonists at the beginning of the 18th century. New York, Pennsylvania, and Massachusetts each sent their wares of brass, iron, and pewter throughout the Colonies, but the better bronzes, Sheffield plate, and silver were brought over from England and France. Some 18th and early 19th century brasses of American and English manufacture are shown in plate 1.

The first four in the upper row are representative forms of the household lamps. The stocky-looking candlestick next in the line is stamped "Palmer & Company, patent." It saw Civil War service at Ft. Sumter. The marine lamp with the light shield, and the two tall candlesticks in the row below, are also war time relics of interesting forms. The candle holders are made of heavy brass; one has a spring for the raising of the candle, and the other swings from a lyre-shaped stand. The three remaining pieces come from various parts of the country, and like all the smaller lamps and candlesticks, they are of the old-style casting. Some of them have been cast over shaped blocks of wood in two or more parts, finished by hammering, then soldered and burnished. The candleholder with tray base and cap extinguisher is an old piece from the home of the late J. P. Morgan in Hartford, Conn.

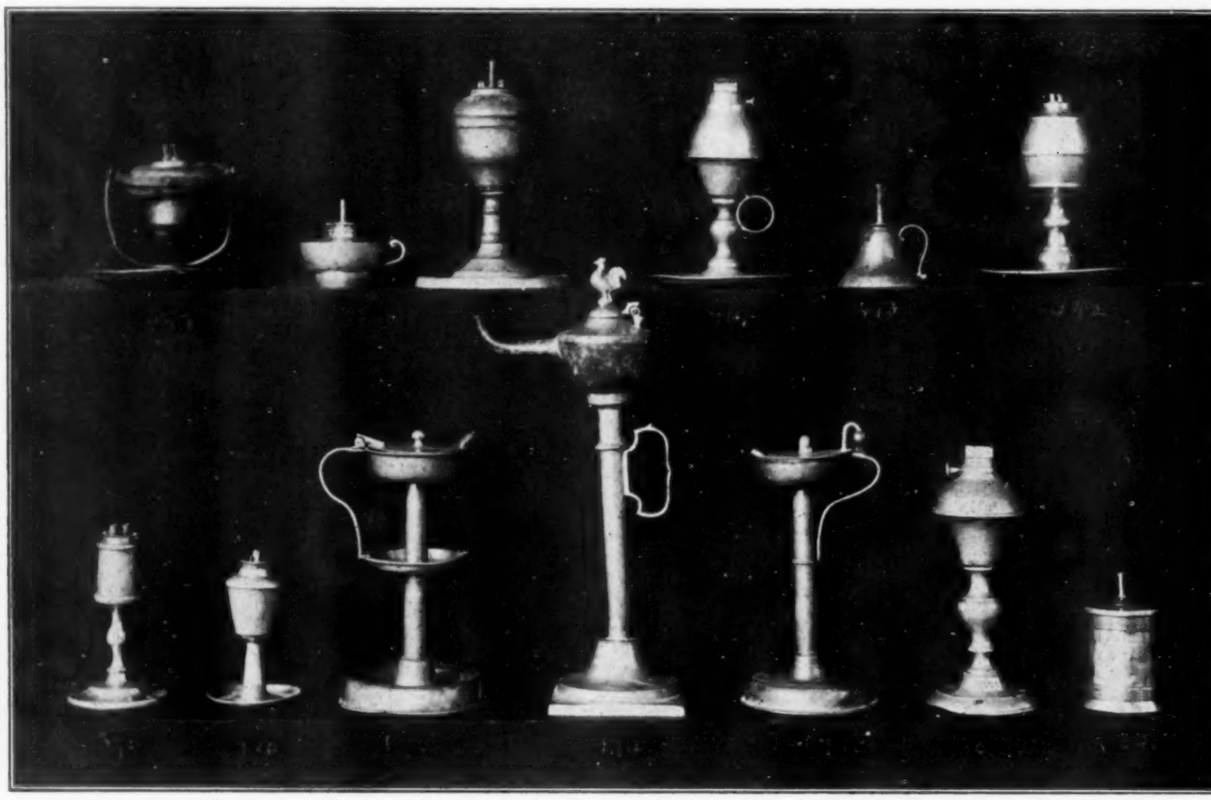


PLATE 2. UNIQUE LAMPS OF STAMPED PEWTER MADE IN AMERICA YEARS AGO.

Lamps of pewter have a special interest for Americans as they were particularly prominent here at the beginning of this country's history, while in Europe they were quite unusual, even at the height of the pewterer's trade. In plate 2 we have a very interesting group of these antique pewter lamps. In the top row, beginning at the left, is a swinging marine lamp for whale oil burning; a low lamp in which lard was used, and this, as well as the next two taller ones, have

wheels and rods for regulating their wicks. The little bell-shaped affair burned camphene, a rectified oil of turpentine, and the last lamp in the row comes from the Hartford works of Boardman and Company, although it is marked New York, a deception that is easily forgiven when it is remembered that in those days New York was already quite a little town, while Hartford was a mere village!

Indeed it was unusual to mark any pewter lamps, and this, with the three tallest lamps in the middle of the lower row, are unique examples, being dated and showing the maker's "touch" or trademark. The marking of pewter cooking and eating utensils was a very important matter and controlled by the Pewterer's company, the London Guild of Pewter Ware Makers. Overmuch lead in pewter will cause the acids in certain foods and liquids to turn to poison, and the stamping was to insure a standard of between five to fifteen parts lead to 100 parts tin or copper. But for lamps there was no such limitation, and for some time there were no regulations regarding the alloy and marking; the only reason for putting the maker's touch on them at all was to prevent the use of lead entirely instead of the composition with the more expensive metals, copper or tin. So in these marked lamps we may be sure are examples of perfect standard weight pewter.

The two little lamps on the left lower row are the type of whale oil burners used in New England in the 18th century, and on the extreme right is a lamp having a flat wick, a new shape in 1783. The tumbler-shaped lamp on the end of this row was owned by the "Monitor's" famous designer. When the streets of the larger towns in the Colonies were first lighted, lanterns were placed on high iron spikes at the cross-roads, or hung from the walls of prominent houses at the street corners. Lanterns placed above the entrances of public buildings and the dwellings of the leading citizens also helped to dispel the darkness; and one and all the watchman tended on his rounds during the night. Within doors, too, lanterns were used to light the halls in many homes, and the churches, as well as the public taverns, court-houses and shops used candle or lamp-lit lanterns.

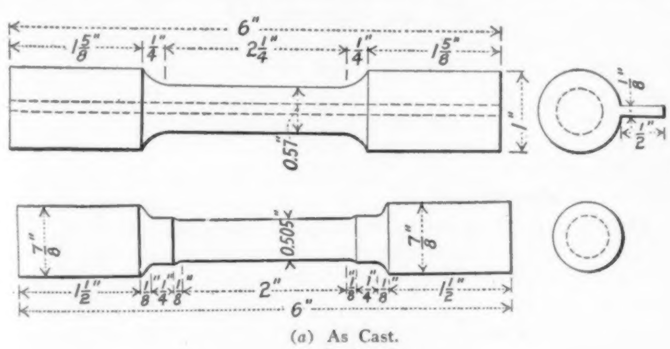
Among the historic pieces included in the collection were lamps and candles from famous homes as varied in character as those of the American poet Longfellow, Vice-President Hannibal Hamlin, Tolstoi, Lincoln, Jefferson Davis, Gen. Hancock, a candlestick from Napoleon's prison on the Island of St. Helena, and many other splendid examples of antique lamps and candles which gave added interest to this very instructive collection, not only from an artistic point of view, but also as to mechanical construction.

STUDY OF THE STRENGTH OF NON-FERROUS CASTINGS: COMPARISON OF DIFFERENT TEST SPECIMENS*

An Article Giving Some Light on the Question of Why Test Specimens Differ from the Castings They Represent.

By L. P. Webbert.

The object of the investigation described in this paper is to note the changes in strength that occur in different thicknesses of metal castings made from the non-ferrous metals met with in engineering practice. The knowledge desired, from the machine-designer's point of view, is to know how to proportion the separate parts of a design with regard to strength, and to know what physical properties to expect from a casting at different points or as a whole.



(a) As Cast.
(b) Finished.

FIG. 1. TEST SPECIMEN FOR 88-10-2 CASTINGS.

DESCRIPTION OF TEST SPECIMENS.

Some metallurgists strive to adopt a test specimen to represent the strength of an alloy which will give the maximum results obtainable for that metal. Such test specimens give results that are interesting but tend to mislead. Quite a number of different types have been suggested for adoption as a standard test specimen, but when we consider the specifications that must be followed in practice our choice becomes decidedly restricted to a few forms. The specifications state that a test specimen is to be a part of the casting and is not to be cast separately. The test specimen must receive the same heat treatment—that is, no chilling of the test specimen is allowable—and must be turned down to a stated diameter.

There are two styles of test specimens made use of in practice, one for the copper-tin alloys and the other for the copper-zinc alloys. The first is that used on 88-10-2 castings (copper 88 per cent., tin 10 per cent., zinc 2 per cent.). This test specimen, as cast with the casting, has the dimensions shown in Fig. 1 (*a*). A ⅛-in. gate running the entire length of the test specimen connects it with the casting. A casting with the test specimen attached is shown in Fig. 2. Being gated in this manner allows the test specimen to be filled quickly with metal and has the advantage of giving the same rate of cooling to every part of the specimen. When the test specimen is detached it is turned down in a lathe to the proper diameter and form as shown in Fig. 1 (*b*). In Fig. 4 (*c*) are shown the forms placed in the parting of the mold; two forms to give test specimens 0.505 in. in diameter, and one to give a test specimen 0.798 in. in diameter. When a test specimen is to be placed at another part of the casting, cores are made use of as shown in Fig. 5 (*b*) and (*c*). At (*b*) are shown cores to give 0.798-in. test specimens and at (*c*) are shown those to give 0.505-in. test specimens.

The test specimen as shown in Fig. 1, with a finished diameter of 0.505 in., is used more than the test specimen having a finished diameter of 0.798 in. A drawing of the 0.798-in. specimen would be similar to Fig. 1, but would show larger diameters and greater thickness of gate.

For the copper-zinc alloys (manganese-bronze and

*Paper read at seventeenth annual meeting American Society for Testing Materials, Atlantic City, N. J., June 30, 1914.

brass) a bar of metal 1 by 1¼ by 6 in. is cast on the side of the casting. Fig. 4 (*b*) shows two patterns for this style of test specimen, the diameter of which is to be 0.505 in. These patterns are placed against flat surfaces. For curved surfaces different patterns are made to fit the curvature of the castings. The round part of the pattern shown in Fig. 4 (*b*) allows the pattern to be drawn easily from the sand. Comments on this style of test specimen will be made again in this paper.

It is well known that to obtain the highest results from 88-10-2 test specimens the least amount of metal should be turned off the specimen. In comparing Fig 1 (*a*) with (*b*) it will be noted that 0.065 in. of metal is turned from

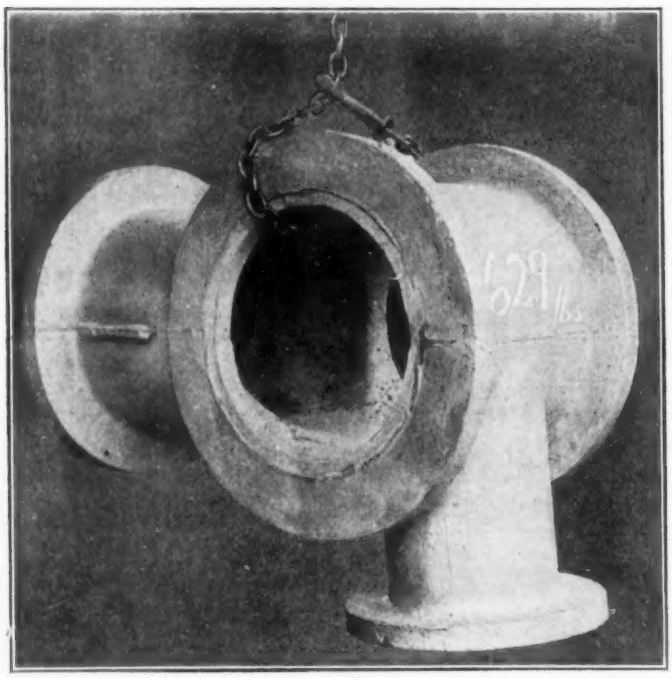


FIG. 2. 88-10-2 CASTING SHOWING TEST SPECIMEN ATTACHED.

the test specimen. In the "skin" of the casting lies the greatest strength, as the foundryman puts it. To illustrate: A large valve body, ¾ in. in thickness, made from 88-10-2 metal, was cut up to procure test specimens from the flange and body of the casting, in order to compare the strength of these with the strength of the test specimen attached to the casting. The test specimen (0.505 in. in diameter) gave an ultimate tensile strength of 40,000 lb. per sq. in. and an elongation in 2 in. of 40 per cent. From the body the following results were obtained:

	Tensile Strength, lb. per sq. in.	Elongation in 2 in., per cent.
1	25,800	13.0
2	25,200	11.0

From the flange the following results were obtained:

	Tensile Strength, lb. per sq. in.	Elongation in 2 in., per cent.
1	23,650	11.0
2	18,850	5.0

When the test specimen was turned down to the proper diameter, very little of the skin was turned off. The test pieces from the interior of the metal possessed no skin and gave lower results. The results emphasize the fact that the test specimen attached to the casting exaggerates the strength of the casting as a whole.

If the diameter of this style of test specimen is increased lower results are obtained. Let us compare the 0.505-in. diameter test specimen (0.2 sq. in. in area) with the 0.798-in. diameter specimen (0.5 sq in. in area). The ratio of the area of the 0.505-in. test specimen to the circumference is smaller (area ÷ circumference = 1.26) than the ratio of the area of the 0.798-in. test specimen to its circumference (area ÷ circumference = 1.99). In the former case we state that there is more skin, so to speak, to the specimen and consequently more strength obtainable than with the larger diameter specimen. The author has averaged 61 tests from large castings having the 0.505-in. test specimen and gives the following average: Tensile strength, 46,580 lb. per sq. in.; elongation in 2 in., 38.7 per cent. Among these tests a maximum tensile strength of 51,650 lb. per sq. in. is noted, with an elongation of 62.5 per cent., which is also the maximum elongation. The minimum tensile strength among the tests is 39,100 lb. per sq. in. with an elongation of 25 per cent. The minimum elongation is 20 per cent. The specifications under which these castings were made required a minimum tensile strength of 30,000 lb. per sq. in. and a minimum elongation of 20 per cent. in 2 in. A specification from another source called for a minimum tensile strength of 35,000 lb. per sq. in. and a minimum elongation of 20 per cent. in 2 in. for a test specimen of 0.5 sq. in. area (0.798 in. in diameter). This style of test specimen was placed on ten large 88-10-2 worm wheels. The tests gave an average tensile strength of 36,324 lb. per sq. in., and an average elongation of 27.1 per cent. The maximum tensile strength among the tests was 42,800 lb. per sq. in., with an elongation of 36 per cent., which was also the maximum elongation. The minimum tensile strength was 29,300 lb. per sq. in., with an elongation of

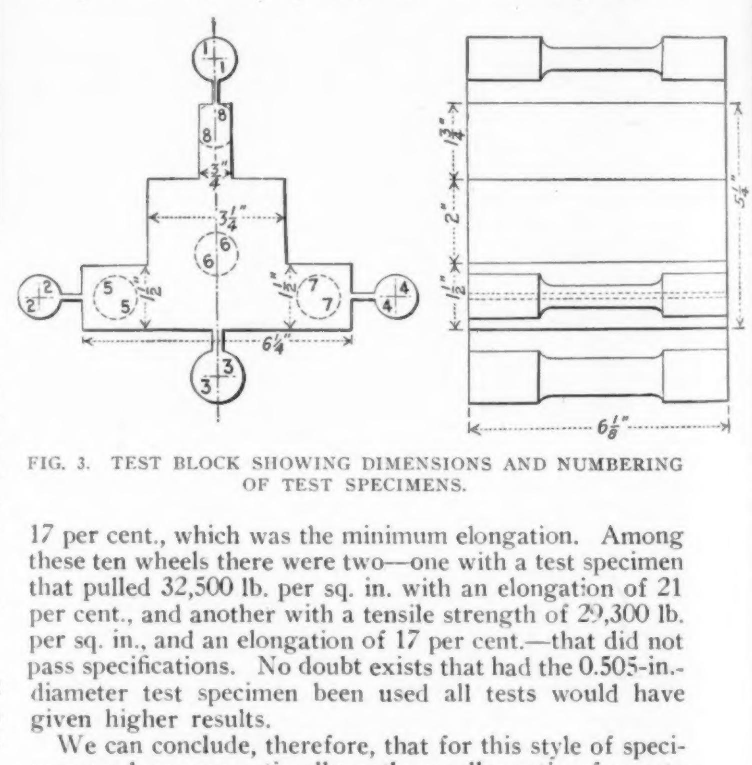


FIG. 3. TEST BLOCK SHOWING DIMENSIONS AND NUMBERING OF TEST SPECIMENS.

17 per cent., which was the minimum elongation. Among these ten wheels there were two—one with a test specimen that pulled 32,500 lb. per sq. in. with an elongation of 21 per cent., and another with a tensile strength of 29,300 lb. per sq. in., and an elongation of 17 per cent.—that did not pass specifications. No doubt exists that had the 0.505-in.-diameter test specimen been used all tests would have given higher results.

We can conclude, therefore, that for this style of specimen used on copper-tin alloys, the smaller ratio of area to circumference of test specimen gives the greater strength. This is due to the fact that in general the rate of freezing of the metal is an important factor in influencing the strength of the casting. The skin of the casting receives the chill of the mold, is the first to freeze, and shows the smallest structure or grain. From the skin, freezing of the metal takes place gradually toward the center of the casting. The rate of freezing depends upon the following factors: (1) The thickness of the casting; (2) the temperature of the metal entering the mold; and (3) the conductivity of the mold.

VARIATION OF THE STRENGTH OF METAL AT DIFFERENT PARTS OF A CASTING.

In order to study the effect of the rate of freezing upon the strength of the metal, castings of copper-tin and copper-zinc alloys were made as shown in Figs. 3, 4 (*a*) and 5 (*a*). Fig 5 (*a*) shows a block made of 88-10-2 metal with the test specimens attached which are used for this metal. Fig. 3 is inserted to show the arrangement of specimens and numbering on blocks made of copper-tin and copper-zinc alloys. Test specimens Nos. 1, 2 and 4 are of the pattern shown in Fig. 1. No. 3 is a similar test specimen to be turned down to a diameter of 0.798 in. Nos. 5, 7 and 8 are test specimens used on castings made of copper-zinc alloys (manganese-bronze and brass). A bar of metal is cut out of the center of the casting and turned down into a test specimen to represent the strength of the metal at the center. The relative advantages of these types of test specimens can be studied, since they are cast together on the same casting, are made from the same metal, and receive the same heat treatment. The specimens on all blocks made were numbered as shown in Fig. 3. Tables I and II give the results of all tests. The test specimens were not threaded but were pulled with grip jaws in the testing machine. In turning down the test specimens, Nos. 5, 6 and 7, were given a diameter of 0.798 in. The diameter was later changed to 0.505 in. in order to obtain uniformity in the size of the test specimens. Test specimen No. 3 was given a diameter of 0.798 in. for all blocks. In some instances this specimen was turned down to a smaller diameter when found slightly defective.

(*a*) (*b*) (*c*)
Fig. 4. (*a*) Manganese-Bronze Test Block.
(*b*) Manganese-Bronze Test Specimens.
(*c*) Test Specimens for Copper-Tin Alloys.

A few changes had to be made when casting the manganese-bronze blocks, on account of the nature of the metal. The risers were made larger, the sprues longer and the gates connecting test specimens Nos. 1, 2, 3 and 4 were made thicker. On the brass blocks the sprues were made similar to those of the manganese-bronze blocks; otherwise they were similar to those of the copper-tin alloys. After casting, the metal was churned in the riser in every case. Specimens Nos. 1, 2 and 4 were attached with the intention of observing how closely they would check each other when tested, thereby testing the reliability of this type of test specimen when made of the different metals. It may be mentioned that this type can not be depended upon when attached to brass castings.

With some alloys a green-sand mold was made. This mold was filled immediately after the dry-sand mold was filled. The metal for both molds was poured from the same crucible. The castings made in green sand gave results that showed no decided variation from those made in the dry sand. The green-sand molds were soon discontinued. Only the average results from the green-sand blocks are given in Table II.

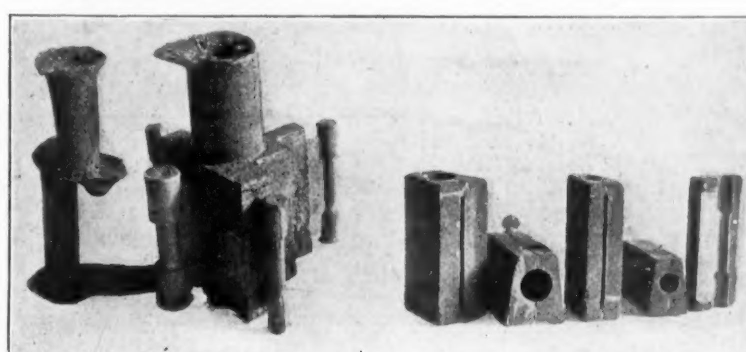
The block for alloy No. 1 was cast after the casting shown in Fig. 2 was poured. This metal was made from the best copper, tin and zinc obtainable, but was not remelted. The temperature was not taken when the block was cast but was lower than the pouring temperature usually desired for such a small casting. The specimen attached to the casting in Fig. 2 was pulled and gave a tensile strength of 49,150 lb. per sq. in. and an elongation of 47.5 per cent.

For alloy No. 2 a different procedure was adopted. In order to get a perfect and homogeneous alloy the metals for this block were alloyed and the resulting alloy pigged. The metal was remelted, brought to the proper temperature in the furnace and cast. The casting after being cut up was found to be perfect.

Alloy No. 8, manganese bronze, gave trouble. At the center of the block near the top sponginess occurred, due to shrinkage. In practice this trouble is overcome by pouring metal at a higher temperature from another crucible into the riser during churning to liven up the metal in the center. Only one attempt was made to make a block of manganese bronze pulling about 80,000 lb. per sq. in. This casting was a failure due to the little shrink holes occurring throughout the casting. One test was good, No. 1, which gave a tensile strength of 79,500 lb. per sq. in. and an elongation of 24 per cent.

The block for alloy No. 9 was not finished and is inserted in Table II because the analysis was made.

Methods of Manufacture.—The alloys used were made by melting the copper under charcoal, then adding the zinc, tin and lead in the order named. The temperature of the melted copper was allowed to become sufficiently high to cause the zinc to flare when added in the case of those alloys requiring a large amount of zinc. To the alloys high in tin, 1 oz. of 15-per-cent. phosphor-copper was added for every 100 lb. of metal after the other metals had been alloyed, the object being to introduce sufficient phosphorus to remove the oxides and leave a trace of phosphorus in the alloy.



(*a*) (*b*) (*c*)
Fig. 5. (*a*) 88-10-2 Test Block.
(*b*) and (*c*) Cores used for Specimens Nos. 1, 2, 3 and 4, Fig. 3.

Manganese-bronze was made by introducing an alloy of iron, manganese and tin into the melted copper when sufficiently hot. This alloy, which is made by melting together iron and ferro-manganese, has an approximate composition of 54 per cent. iron, 21 per cent. manganese and 25 per cent. tin. When this mixture is melted the tin is introduced to lower the melting point. The amount of this alloy introduced depends upon the percentage of iron desired in the bronze. Tin is added later with the zinc to keep the percentage of tin at 0.8. After the above

alloy had dissolved in the copper the aluminum was added and then the zinc and tin. The manganese bronze was pigged before being used again.

TABLE I.—ANALYSES OF ALLOYS.

Alloy No.	Percentage of Copper.	Tin.	Zinc.	Lead.	Iron.	Manganese.	Aluminum.	Phosphorus.
1	88.31	8.49	3.20	...	...	...	...	trace
2	87.98	10.64	1.28	0.10	...	...	...	trace
3	86.78	6.31	5.96	0.92	0.03	...	...	trace
4	84.28	11.31	4.15	0.06	0.06	...	...	trace
5	62.81	0.79	26.18	0.09	0.05	0.02	0.06	....
6*	62.81	0.79	26.18	0.09	0.05	0.02	0.06	....
7	84.49	...	15.49	...	0.02	...	...	....
8†	....	...	...	...	...	...	...	....
9	57.66	0.84	39.85	...	0.69	0.16	0.58	....
10	89.08	7.48	3.00	0.07	...	...	...	0.20

*Alloy No. 5 remelted.
†Analysis not made. Manganese bronze.

TABLE II.—RESULTS OF TESTS.

ALLOY NO. 1.—COPPER-TIN; NEW METAL; NOT REMELTED.

Test Specimen No.	Diameter of Test Specimen, in.	Tensile Strength, lb. per sq. in.	Elongation in 2 in., per cent.
1	0.505	40,800	28.0
2	0.505	43,250	32.0
3	.....	......	....
4	0.798	35,720	24.5
5	0.505	33,750	22.5
6*	.....	......	....
7	0.798	33,080	21.0
8	0.505	34,600	24.0
Average	.....	36,866	25.3

*Specimen broke in lathe.

ALLOY NO. 2.—COPPER-TIN; NEW METAL; PIGGED AND REMELTED.
Temperature of Metal, 2,300 degs. F.

Test Specimen No.	Diameter of Test Specimen, in.	Tensile Strength, lb. per sq. in.	Elongation in 2 in., per cent.
1	0.505	51,250	42.5
2	0.505	50,300	40.5
3	0.798	40,660	23.5
4	0.505	50,400	39.0
5	0.798	33,740	14.0
6	0.798	28,560	9.5
7	0.798	34,200	16.0
8	0.505	40,550	28.0
Average	.....	41,201	26.6

In taking pyrometer readings no attempt was made to get the casting temperature at the mold, because the pyrometer in use was a base-metal couple that was not sufficiently sensitive to give quick accurate readings; also because pyrometer readings are best made at the furnace, on account of the necessity of removing the metal from the furnace when the proper temperature has been reached. This procedure does not allow the metal to overheat or "soak" (that is to remain in the furnace an unnecessary length of time), which injures the alloy. In Table II the temperature given is the temperature taken at the furnace.

CONCLUSION.

On comparing the different tests we can conclude that the 88-10-2 test specimen as shown in Fig. 1 is convenient to use on copper-tin alloys. Incidentally, it may be noted that the average strength as given in Table II is approached by the strength of specimens Nos. 3 and 8 for the copper-tin alloys, and by No. 8 for the copper-zinc alloys. The 88-10-2 specimen with its narrow gate was attached to a block of manganese bronze with no success. The gate was then widened to the thickness of the test specimen at the middle as used on the blocks for alloys Nos. 8 and 9. The adopted test specimen for manganese bronze (0.505 in. diameter) took the form shown in Fig. 4 (*b*). The 88-10-2 specimen was not successful with brass due to small cracks forming in the specimen. The small cracks were not noticeable until the specimen was tested. The rate of freezing appears not to affect the copper-zinc alloys to as great an extent as the copper-tin alloys. The strength of alloy No. 2 varied from a tensile strength of 51,250 to 28,560 lb. per sq. in., while that of alloy No. 7 varied from a strength of 31,700 to 29,000 lb. per sq. in. With this copper-zinc alloy no cracks developed in the test specimens Nos. 1, 2, 3 and 4.

Considering a test specimen to represent the strength of a copper-zinc alloy, we can choose such a specimen as Nos. 5 or 6 for a diameter of 0.798 in., or No. 8 for a diameter of 0.505 in. (the specimen shown in Fig. 4 (*b*) is identical with No. 8). But when the copper-tin alloys are considered we can not make a choice. In a gear blank made from 88-10-2 metal, the surface of the metal is cut away to form the teeth of the gear. It is evident that the strength of the teeth could not be represented by test specimens Nos. 1, 2, 3 and 4. If a bar of the same metal is turned down to the size of a bolt, the designer's calculations must be based on the strength of the metal represented by specimens Nos. 5 and 7.

In this paper the author has endeavored to point out, with a limited number of tests, how the strength of metal varies with changes in the thickness of castings, what strength to expect from different alloys, and how a study was made of the different types of test specimens used in practice.

THE JOYS OF A PLATER.

By J. W. FORCE.

A plating room and a steamboat
  Are very much the same.
In regard to the men who run them,
  Just a difference in the name.

The foreman is the captain,
  His assistant is the mate.
There are Italians and Pollocks
  In a room that's up to date.

The foreman acts as pilot
  To keep them off the rocks
And he's the unlucky victim
  That everybody knocks.

From seven in the morning
  He must be looking out for squalls,
And if everything don't go just right
  He's sure to get some calls

From an angry superintendent,
  With a letter in his hand,
Who jumps into the plating room
  Like half a ton of sand.

"I have just heard from John Boor,
  Our top notch traveling man.
He says the work is rotten
  We shipped to Smith & Khan.

The nickel is full of scratches,
  The brass is tarnished bad;
It is not as good as Flitch's,
  It is the worst we ever had."

If the packing room is leaky,
  And one-half the goods get wet,
Or the tariff causes a panic,
  And orders are hard to get;

If the package contains a shortage,
  Or the goods have holes in the stock,
Don't hesitate a moment
  To give the plater a big knock.

MODERN PLATING PRACTICE

Finishing Antimonial Lead and Spelter Novelties in Ormolu Gold, French Grey, Bright Silver, Ivory, Old Ivory, and French Bronze.

A. A. Le Fort.*

The first process employed for the production of Ormolu gold on antimonial lead is as follows: After work has been cut down and washed, it is then sand-blasted or satin finished on No. .0010 steel wire wheel, cleaned in the usual way in a suitable cleaning compound (I find Kalye superior to caustic soda or potash cleaners for this metal, as it does not form oxides or stains as readily as other cleaners do, thus avoiding scratch brushing, but when work does get stained or coated with this film, it is almost necessary to brush the work before plating.

After work is cleaned, plate in cyanide of copper solution for five or ten minutes, or until work is coated evenly, rinse, then plate in the acid copper solution from one to one and one-half hours, the time depending on the different shaped articles, plain work being plated the shortest, and work with deep depressions or exposed edges or points, the longer time, so that work can stand the acid dipping, without acid cutting through the deposit. The copper coating must be heavy, as first-class work has to be dipped two or three times before a perfect dipped or matt surface results. Sometimes articles will come out perfect with only one dip, but two out of three pieces generally require more. After dipping articles, rinse thoroughly, run in stain dip (cyanide of potassium), then brass plate for a short time in a green brass solution, only for the length of time required to coat articles evenly, rinse, then color in gold solution, either one of the regular or the salt water solutions, rinse thoroughly in cold water, then in hot soap water, then hot water, dry either with towels or cloth, or in hot oven to avoid staining. I find that by using common laundry soap, instead of plater's compound or whale oil soap in the water, that work does not stain so easily, and that lacquering is more satisfactory as, if the whale oil soap water is a little heavy, it has a tendency to form an oily film on the work and prevents the lacquer from adhering properly, while not near as much trouble is caused with the use of the laundry soap. When work is dry, it is then burnished on high lights, wiped with soft cloth and lacquered. For the cheaper lines of goods no sand blasting or satin finishing is required. Just clean, give light plate in cyanide copper bath, then in acid copper bath, for about one-half hour, as only a quick acid dip is required (have given some work, such as ring boxes, pin cushions and other small articles, only twenty minutes in the acid copper bath and work turned out satisfactory). Outside of omitting the sand blasting or satin finishing and giving the work a lighter copper plate, the same process is employed in finishing the cheap grade as is employed for the first-class goods.

Some of the cheapest goods are not cut down or polished at all, they are simply trimmed (removing burrs produced in the casting) and directly potashed and plated.

SPELTER ARTICLES.

Spelter work requires more care in handling than the antimonial lead, that is in the first process employed in preparing work for the acid copper bath. It will be found safer to potash or clean the work and scratch brush, whether stained or not, then cyanide of copper plate, and plater must be sure that the coating in the cyanide copper is heavy enough, and that articles are plated so that every part is thoroughly covered inside and out to protect the spelter from being attacked by the acid in the acid copper bath. I would advise plating spelter goods at least one-half hour in the cyanide bath, to obtain perfect results. When jewelry boxes are being plated, it is safer to pass them through the stain dip, before copper plating, to avoid failing (peeling) of the brass hinges, which generally are stained by the cleaners.

The plater must also use great care and be careful not to burn the work, in the acid copper bath on the edges or exposed parts, as frequently happens if solution is not heavy enough in metal, work too close to anodes or too much current is employed, as the burnt parts of articles cannot be gold plated successfully, the burnt parts coming out too dark, or red, thus spoiling the finish and articles so that they would have to be stripped and refinished.

FRENCH GREY.

Clean and plate articles by first striking in silver solution, then in regular silver plating solution for about one-half hour, rinse in cold water, then dip without brushing in liver of sulphur solution, finish with small tampico wheel with water and fine pumice, and run over plain parts with soft cotton buff, using pumice and water, rinse in cold water, then hot water, and dry with cloth or towels, then lacquer. To produce a darker tone in the backgrounds, scratch brush articles over the figured parts only, before using the pumice and water.

BRIGHT SILVER.

Clean and plate articles for fifteen or twenty minutes in nickel solution, rinse in cold water, strike in silver, then plate in bright silver solution for four or five minutes, color on soft canton flannel buff, going over work very lightly, as very little buffing is required, as work comes out very bright from solution of lacquer articles.

IVORY.

Clean articles, plate in cyanide copper, then in acid copper bath for ten or fifteen minutes, or until an even deposit of copper is obtained, rinse, run through stain dip (cyanide), then in silver strike, then in regular silver solution (not bright) until an even white deposit is obtained, rinse thoroughly, dry with towels, burnish high lights, then lacquer. Work must be handled carefully to avoid scratching or chaffing the plain surfaces, and good clean cold and hot water used to avoid staining. Articles are sometimes plated satisfactorily by only using the strike solution, if plater is careful to keep same in good working order, and regulating the current to avoid a coarse, grainy or yellow deposit, as only a light deposit is required.

OLD IVORY.

Sandblast or satin finish articles on heavy wire wheel, in order to cause the enamel to adhere to surfaces more firmly, then spray on two coats of No. 40 white enamel and one coat of white gloss enamel (celluloid zapon). Then make a mixture of chrome yellow, English vermilion and Van Dyke brown colors in oil to shade desired, then add a little copal varnish, linseed oil and turpentine, daub over articles with paint brush, wipe off high surfaces with soft cloth before coloring dries or sets too hard, leaving coloring in the background. If brown color is too prominent blend out by stippling with soft brush, then rewipe high surfaces. Other shades can be

*Foreman plater, Pass & Seymour, Inc., Solvay, N. Y.

obtained by using different pigments, but the one here mentioned gives most any shade of browns required. Some platers prefer to give articles a light silver coating, before applying the enamel, but as the enamels mentioned have a good covering body, the silver plating is not required, thus doing away with the extra labor and expense. If the spray method cannot be used, articles can be dipped, while brushing the enamel is not recommended as it is a difficult operation to do a satisfactory piece of work, unless used by a skilled or experienced brush hand.

FRENCH BRONZE.

Clean articles, then give a heavy copper, plate in both the cyanide and acid baths, then dip in

Carbonate of copper	½-pound
Sulphate " "	1 "
Water, use hot	1 gallon

Scratch brush, then return to dip and repeat operations until desired color results. Make a mixture of copper carbonate or chrome green, with copal varnish, linseed oil and turpentine, daub with brush in background and wipe off high lights.

The following solutions are used to advantage for Ormolu finishing:

Copper Solution:

Carbonate of copper	3 ounces
Cyanide potassium	6 "
Bisulphite soda	2 "
Carbonate soda	2 "
Water	1 gallon

Brass Solution:

Carbonate of copper	25 pounds
" " zinc	15 "
" " ammonia	15 "
" " soda	50 "
Cyanide potassium	25 "
Water	100 gallons

A little more cyanide may be added to the brass bath if necessary to clear solution, and copper anodes used. By the use of copper anodes in a brass bath, the color of deposit is kept more uniform than when brass anodes are used, on account of the various compositions of brass anodes. The copper contents remain nearly correct for a long time, and any changes noted in the color of deposit are generally remedied by small additions of zinc carbonate. I would recommend the use of copper anodes in all brass baths, having done so for a number of years with best results, and solution is much easier to control where only one of the metals has to be added.

(1) Acid copper:

Sulphate of copper	¾-pound
Sulphuric acid	2 to 3 ounces
Water	1 gallon

(2) Sulphate of copper dissolved in water by hanging in bags of cloth to stand 14 degs. hydrometer and brought up to 16 degs. hydrometer with sulphuric acid. By adding one or two pounds of steel or iron shavings to about 100-gallon bath the deposit will be softened, and about ½-ounce of molasses or a small amount of dextrine (made into a paste) to each gallon, the solution will be more dense, and bath will stand more current without burning work.

GOLD SOLUTIONS.

(1)

Water	1 gallon
Cyanide	½-ounce
Phosphate soda	6 ounces
Bisulphite soda	½-ounce
Gold chloride	2 or 3 pennyweight

(2)

Water	1 gallon
Cyanide	1 ounce
Phosphate soda	4 ounces
Bisulphite soda	¼-ounce
Gold fulminate	6 pennyweight

In the gold solution the use of too much cyanide is not advisable as the deposit gives a reddish tone, which does not occur when phosphate of soda is used as the principle conductive salts. Use either gold, carbon or platinum anodes.

SALT WATER GOLD SOLUTION.

Water	1 gallon
Gold fulminate	2 pennyweight
Phosphate soda	2 ounces
Yellow prussiate potash	4 ounces
Carbonate of potash	1½ ounces
Sulphite of soda	1 ounce

No anodes are required in the solution, the zinc and copper (battery) furnishing the current and acting as anodes.

APPARATUS USED FOR SALT WATER GOLD PLATING.

Outside tank should be made of copper, or a wooden tank or barrel, lined with sheet copper, or copper anodes suspended from same can be used. Into this tank the following solution is used: 1 pound rock salt, ½-pound sal ammoniac, water, a gallon. Next a porous jar is put inside of tank and gold solution made up in jar, on the outside of the porous jar a circular piece of zinc is used, to which a brass pole or rod is connected, and used as the negative or work pole, the copper acting as the positive pole. Heat the salt solution in the outside tank, and keep both solutions hot while in use. The contents of tank and jar should be kept up to the same height to prevent one or the other solutions from leaking from or into the porous cup. Solution is kept in working order by adding gold fulminate and yellow prussiate potash. If slow add more salt and sal ammoniac. When solution is not in use remove zinc from solution, as the acid attacks it and cuts it down and destroys the solution in a short time.

For gold plating in either the regular or salt water baths a light striking of the articles in a silver strike will give the same results as when the brass solution is used. The operator must use care that work is not coated too heavy in the strike, as the results will be the same as when work is burned in the acid copper solution, namely, red or pink color on edges of work.

ACID DIP.

Oil vitriol 2 parts, aqua fortis or nitric acid 1 part. Lamp black or calcined soot to soften dip and either muriatic acid or common salt to brighten. The soot or lamp black can be omitted, but the use of an old copper anode used in a new dip for some length of time, to kill the fire or sharpness, is recommended before dip is used for regular work.

SILVER STRIKE.

Water, 1 gallon; cyanide potassium, 10 ounces; silver chloride, ½-ounce.

SILVER SOLUTION.

Water, 1 gallon; silver chloride, 1½ to 2 ounces; cyanide, 6 ounces.

BRIGHT SILVER SOLUTION.

Water, 1 gallon; silver chloride, 1 ounce; cyanide potassium, 8 ounces. Dissolve bisulphide of carbon in

cyanide in boiling water, ½-ounce carbon to 4 ounces cyanide, 1 pint water. Use all of this solution to 100-gallon bath. Add more carbon cut in cyanide from time to time to keep bright. Other formulas for the use of bisulphide of carbon have been given in THE METAL INDUSTRY and might give better results than above, but this formula will be found satisfactory for use for a light plate.

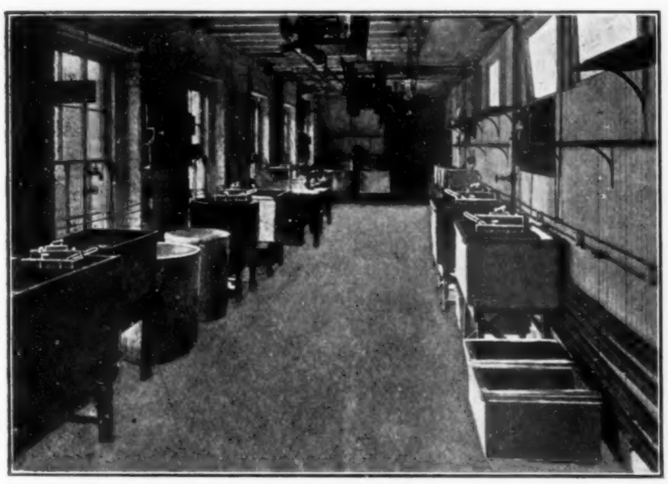
ELECTRO-DEPOSITION OF PURE NICKEL

SOME MODERN VIEWS ON THE PROBLEM OF ELECTROLYTIC DEPOSITION OF METALS.

BY F. A. ROJAS.*

There are two distinct processes in the electro-deposition of cations from an electrolytic bath, namely, reduction and oxidization; that is, the deposition of metals in a reduced or metallic state, or the deposition of metals in an oxidized condition. Previous to my discovery and invention of the Electrochroma process, whose object is the electro-deposition of "oxides" upon the cathode or negative electrode; that is, the deposition of all kinds of colors, in as much as the colors of the metallic oxides comprise all the chromatic variety of the spectrum, the art of plating was limited to the electrolytic reduction of metals, and to this art belongs the plating of metallic nickel.

After a careful investigation of the condition, both chemical and physical, that would determine either reduction or oxidization within an electrolyte I have learned that most of the present formulae that are used in every day plating and which undoubtedly aim to the strict electrolytic reduction of metals are of such a nature that they tend to perform simultaneously both oxidization and reduction. This anomaly is accountable for the every day failures in the practice of this art, as from most of the electrolytes built in accordance with these formulae, the metal is precipitated with contamination by oxides and occlusions of foreign substances.



DEMONSTRATION LABORATORY, FITTED UP AS A MODEL PLATING PLANT, LATEST IDEAS IN TANKS, ELECTRICAL EQUIPMENT, ETC. BATHS WORKING UNDER COMMERCIAL CONDITIONS.

SHOWING INTERIOR PRIVATE LABORATORY FOR EXPERIMENTAL RESEARCH. PLATING DYNAMO. HUNDREDS OF DIFFERENT CHEMICALS, INCLUDING MANY RARE ELEMENTS.

After a careful research and scientific study of this phenomenon, I have found that these wrong conditions are greatly accentuated in the case of nickel plating, as the electro-plated nickel obtained from them does not exhibit by far the whiteness and brilliancy of the pure metal, and this is due to the fact that nickel oxide and other foreign substances are precipitated or plated together with the metallic nickel.

With these facts in mind I have succeeded in composing a nickel bath, strictly complying with the principles of electrolytic reduction. In this bath every condition, both chemical and physical, that aims to eliminate oxidization, non-coherence and unevenness of the deposit has been carefully considered. This bath fully satisfies all the requirements that are desired for the successful workings of nickel plating. It produces a deposit that exhibits all the characteristics of the metal itself in whiteness, texture and lustre; it is very simple and practical to build, for all that is necessary is to dissolve this new salt in cold water, and it will be ready for immediate use; it is easy to manipulate and to keep in good condition as any obnoxious chemical substances have been eradicated.

And, in regard to the physical consideration, the electrical adjustment is most successfully accomplished; for in its operation use is made of the Rojas direct ampre rheostat, which was described and illustrated in the June issue of THE METAL INDUSTRY. With this rheostat the bad features derived from the poor conductibility of nickel baths and the evils of counter currents are practically eliminated, and the metal deposits just as readily in the indentations and deep recesses as it does on the high lights of the cathode surface.

Other good features of this bath are its stability, speed and beauty of the thick deposit obtained from it. In the first instance because there is no loss of volatile substances, no atmospheric reaction, and its replenishment of metal at the expense of the anode is effected with a remarkably high degree of efficiency; second, because an even deposit both in the high as in the low lights of the work can be accomplished in a shorter time than it is done with other baths, and, third, because of its good behavior in continuing to deposit a white and brilliant nickel irrespective of the length of time the plating is carried on.

The chemical and physical principles stated above, that is, a strict electrolytic reduction of the deposit and a correct application and control of the electrical conditions, are essential not only for the successful performance of nickel plating, but they must be observed also in the building and manipulation of any bath intended for the electro-deposition of any other metal.

*President of Rojas Electro-Chemical Company, New York.

A RATIONAL TEST FOR METALLIC PROTECTIVE COATINGS*

A Method Devised for Making Comparisons on the Durability of Galvanizing, Sherardizing and Lohmanizing.

By J. A. Capp.†

There are several processes commercially used for covering the surfaces of metals easily corroded or rusted, such as iron in its several forms, with other metals less easily corroded, or with metallic oxides. These may well be called "metallic" protective coatings in distinction from the types of coating which are in the nature of paints or their equivalent.

The object of the application of these metallic protective coatings is to enable the coated articles to resist atmospheric exposure without rusting for a longer time than they could withstand such exposure without protection. Obviously, then, the only final test of the efficiency of a given type of coating is actual exposure to the same sort of influences that the material is supposed to resist in service. If the coating is at all efficient, this takes so long a time that more rapid methods of determining relative efficiencies become a necessity. The most commonly used methods of testing such metallic protective coatings are those of chemical attack, which in effect measure either the thickness or the weight per square unit of the protective coating. Such methods of chemical attack permit the comparison of results obtained from tests upon the same sort of coating, but difficulty is encountered when attempt is made to compare the results obtained by such tests on one sort of coating with those obtained on another character of coating. For instance, the well-known Preece test yields excellent comparative results on galvanized coatings. When, however, it is used for coatings applied by the sherardizing process, the results are not at all comparable. Neither is the Preece test applicable to coatings of tin or of lead. In the case of sherardized articles, it has been suggested that the coat, which is a combined structure of zinc and zinc oxide, together with some zinc-iron alloy, be removed in strong alkalies which will not attack the iron beneath. This would enable one to determine the weight of coating per unit of surface calculated to metallic zinc, but experience has shown that the results do not necessarily indicate the efficiency of the coat, and that it is not easy to determine the relative proportions of zinc and zinc oxide. Furthermore, comparison of the efficiency of a sherardized coating with ordinary galvanizing is not possible when the sherardized coating is tested by solution in a caustic alkali, while the galvanized coating is subjected to the Preece test.

Some years ago, when testing electrical insulation such as is used for overhed line construction, we found that material which stood fairly well when immersed in water failed badly when exposed to the weather, especially if exposed during a hard rain. This led us to produce a rain in the laboratory by sending a stream of water through an ordinary rosette such as is used with a gardener's watering can. The results were encouraging, but too severe, because the individual streams played steadily on one spot and produced erosion. Then we tried an atomizing nozzle, projecting a cloud of moisture into a chamber in which the test specimens were exposed; the results were better, but there was still a possibility of some wear if the article was directly in the path of the stream and near to the nozzle. The problem seemed to be solved when care was taken in placing the articles to keep them out of the direct path of the jet issuing from the atomizing nozzle. As experience was gained with this type of test, as applied to insulating material, it was found that what seemed to be the essential requirement was the maintaining of an atmosphere substantially saturated with moisture; and this saturated-atmosphere exposure has been one of the tests regularly applied to all insulating materials intended for outdoor use since it was first worked out some fifteen years ago. It has been found to give reliable indications of the ability of insulation to resist weather, except, of course, as such ability is affected by extremes of heat and cold, erosion from the wind carrying dust particles, etc.

The problem of determining the resistance of protective coatings to weather corrosion is very similar to that of testing insulations for their weathering qualities. The conditions of exposure are the same, and hence there seemed to be no essential reason why the saturated-atmosphere test would not apply equally well to protective coatings as to insulation. Tests were begun several years ago to try out the method, and the only fault found with it was that it was somewhat slow. Good coatings did not show any signs of breaking down after several weeks of continuous exposure to the fog; yet there was encouragement in the fact that bare metal began rusting in a few hours, and rust spots began developing on poorly protected surfaces in from a few days to a week.

The fact that more trouble is experienced with trolley-line suspensions along the seashore than with the same devices inland, led immediately to the trial of an atmosphere saturated with salt water, with astonishingly satisfactory results.

As now used, the test consists in exposing the articles in any convenient chamber into which there is projected an atomized spray of water saturated with common salt in solution, care being taken to avoid placing the test specimens directly in the path of the jet. To insure constant saturation, an excess of salt is kept in the water at the bottom of the chamber. The spray is produced by a jet of compressed air lifting the water to the nozzle, whence it is projected as a cloud. This apparatus is the common atomizer, so-called, used in the household. The chamber is necessarily not tightly sealed, but is open sufficiently to permit "breathing"; when used with an air jet, there is a slight pressure which is relieved through the breathing openings. If desired, the test may be modified by the use of a fine steam jet to raise the temperature of the atmosphere in the chamber. There is also the possibility of rendering the test atmosphere slightly acid or alkaline by suitable additions to the water in substitution for the salt. For use with plain water, the closet generally used for cement testing does very well, provided care is taken that it is so arranged as to maintain the air practically at 100 per cent. relative humidity. When using salt solutions, recourse must be had to the atomizing jet to insure the development of the salt fog.

When exposed as described, articles have a very thin film of moisture over their surface, but there should be very few, if any, drops of sensible size on the objects. Obviously, the test is very searching, as all parts of the surface are exposed, and any pin holes or uncovered areas become evident. This gives one an opportunity to learn something of the efficiency of any protecting process in taking care of edges, sharp corners, porous spots in the metal surface, etc. By noting the character of the

*Paper read at Seventeenth Annual Meeting of American Society for Testing Materials, Atlantic City, N. J., June 30-July 3, 1914.

†General Electric Company, Schenectady, N. Y.

final general break-down, a very good idea of the evenness of the coating applied may be obtained.

The method of test may be applied to bare metals as well as to those coated to prevent rusting. For this purpose, the plain saturated atmosphere is apt to be better than a salt atmosphere, because the latter may be too severe and hence make comparisons rather difficult.

The salt-spray test, as we have called it, has been used in the laboratory with which the author is connected for a number of years, and during the last four or five years it has also been used commercially as a check upon the process of sherardizing which is in use. The coated articles are exposed to the salt fog, and are examined from time to time to note their surface condition. When the coated material is iron in any of its several forms, red rust begins developing as soon as the coat breaks down. This rust may appear in small pin points which gradually extend, or it may appear generally over the surface of the article. When the coating is relatively thin and poor, rust may develop in from 2 or 3 hours to 24 hours, or longer. A better coat will last 2 or 3 days, but a well-applied coat of requisite thickness will last at least a week. If no rusting is developed in two weeks' time, it may safely be assumed that the life of the coating will be practically indefinite. These figures are based on experience with both sherardized and galvanized types of coating. Other types give results which lie in approximately the same range.

This method of testing is not offered in replacement of other methods of testing which have long been in use, especially when such tests are used solely for comparison on material treated always by the same process. It has, however, almost entirely displaced all such methods of test in our own practice, especially when comparisons are desired between processes of different character, because it is the only test which we have been able to devise which approximates practical conditions, and yet yields results within a reasonably short time. The salt-spray test is only an exaggeration of what may be expected at the seashore and differs only in degree, not in kind, from the normal conditions under which the article is intended to be used.

SECONDARY METALS FOR 1913

A Report of the Metals Recovered From Material Nominally Called "Waste."

INCREASE IN LEAD RECOVERY.

The secondary lead recovered in 1913 amounted to 72,834 tons, or about 5,700 tons more than in 1912. The secondary lead recovered as pig lead increased about 2,800 tons, a normal increase in view of the fact that the average lead price was nearly the same in 1912 and 1913. The recovery of lead in alloys increased 2,900 tons compared with 1912.

LARGER DOMESTIC PRODUCTION OF SECONDARY ANTIMONY AND DECREASED IMPORTS OF ANTIMONY.

The production of secondary antimony, of which all but 45 tons was recovered in alloys, increased from 2,506 short tons in 1912 to 2,705 tons in 1913. The value given is arbitrary and is based on the average yearly price for Cookson's antimony given by the American Metal Market. The only antimony ore of domestic origin smelted in the United States in 1913 was 116 tons from Nevada, which was mined prior to 1912. The regular smelters reported the recovery of 92 tons of antimony contained in antimonial lead scrap. The principal materials refined or remelted which contain antimony as an alloy were hard lead drosses, babbitt, solder, pewter and type metal. The 1913 imports of antimony as metal, in ore, or as oxide, amounted to 7,692 tons, and the recovery from secondary sources was equal to 35.1 per cent. of the imports. The secondary recoveries of antimony were 500 tons more than the antimony content of antimonial lead or antimony ores of domestic origin smelted in 1913.

RECOVERY OF OLD TIN IMPORTANT FACTOR IN SUPPLY.

Apparently there were no domestic tin ores smelted in the United States in 1913, though some tin concentrates were shipped from Nome, Alaska, Gaffney, S. C., and Spearfish, S. D., to Great Britain for treatment. This condition makes secondary tin an important factor in supplying domestic consumption. The secondary tin recovered in 1913 was equal to 27.2 per cent. of the tin, as metal or as oxide, imported into the United States during the year (52,141 short tons). Secondary tin recoveries decreased from 15,401 tons, valued at $14,301,368, in 1912, to 14,178 tons valued at $12,567,379, in 1913.

The recovered tin includes the tin content of products made by several plants from tin scrap. These included some tin oxide, putty powder, etc., but consisted mainly of tin chloride. The production of these compounds is calculated as metal and not separately stated, in order to avoid disclosing confidential information. As the products are made from scrap tin and thus conserve the primary metal, they are properly regarded as recovered tin. Two forms of tin chloride are handled commercially—stannic and stannous salts. Stannic chloride is usually sold either as a water solution, called bichloride of tin, or as an anhydrous sirupy liquid, termed tetrachloride of tin, and is used principally in the silk industry. Stannous chloride is sold in the form of crystals and is used in dyeing and calico printing.

ALUMINUM RECOVERY.

For the first time the Survey obtained statements of the quantity of secondary aluminum recovered as pig aluminum or in alloys, and while the inquiry may not have reached all producers, the result showed that the percentage of secondary aluminum used compared with virgin metal was fully as large as in other non-ferrous metals. The recoveries in 1913 amounted to 4,654 tons, valued at $2,199,480. Of the 4,654 tons the quantity recovered in alloys amounted to 2,456 tons, and over 90 per cent. of this was an alloy of 92 per cent. aluminum and 8 per cent. copper, used for making sand castings. It is probable that a large part of the secondary pig aluminum was recovered from clean clippings and borings, and that it also was utilized in making castings.

TESTS FOR GALVANIZERS.

"The copper sulphate and the lead acetate tests for galvanized material require care and accuracy in carrying out the details if comparative results are to be expected.

"For the thorough testing of galvanized products it would seem advisable to employ the copper sulphate test for the purpose of indicating the uniformity of the coating or the thickness of zinc at its thinnest point, the lead acetate test being used to find the amount of zinc deposited per unit area of surface, while the caustic soda test gives evidence of the continuity of the coating, and furnishes also an indication of how the galvanized product stands the bending test. It is only by employing all of these tests for galvanized products that an intelligent idea of the comparative values of zinc coatings may be obtained and defects made evident."

EDITORIAL

OLD SERIES. Vol. 20. No. 7. NEW YORK, JULY, 1914. NEW SERIES. Vol. 12. No. 7.

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CONTENTS

CORROSION AND EROSION

The corrosion and erosion of metals is one of the greatest difficulties the engineer has to contend with. Frequently corrosion and erosion act together, as for example, the corrosion of brass and copper tubes in locomotive fireboxes. The sulphur and other gases act on the copper and corrode it, and the fine ashes erode the metal by cutting it away. As is well known, corrosion is not limited to the non-ferrous metals; in fact, the most easily corroded common metal is iron, but engineers protect it as much as possible by coating with tin, zinc, or paint. It can also be rendered "passive" and is then non-corrodible, but the various processes are patent. The corrosion of non-ferrous metals is not easy of prevention.

Corrosion may be divided into classes, for example, corrosion due to oxidation; chemical corrosion due to solvent action of acid or alkaline liquid; corrosion set up in the metal itself; corrosion set up by different metals in contact with one another in a saline or acid liquid; corrosion due to the actual decay of the metal, and erosion. Is it any wonder then that it is impossible for anyone to draw up a specification of a metal and say this metal will withstand corrosion. It is unfortunate for engineers that gold and platinum are so expensive, they are practically the only metals which will withstand corrosion. Of the various kinds of corrosion we have mentioned some of them have a tendency to act together and exaggerate the fault. The principal non-ferrous metals affected by oxidation corrosion are zinc and copper sheets where exposed to the weather; in the case of copper the oxidation is assisted by carbonic acid gas forming a carbonate of copper. This latter corrosion is very beautiful from an artistic point of view; some old roofs look very well in this natural coating. It cannot be obtained in the laboratory anywhere near equal to the natural corrosion. In the case of zinc the formation of oxide has to be prevented by paint or the metal would rapidly corrode away.

All commercial non-ferrous metals are attacked by acid liquids to a certain extent even when dilute; also sea water and alkaline liquids attack them. Chemically pure metals are, as a rule, much more easily attacked than those not so pure; this is especially the case with electrolytically deposited metals. Metals in the electrolytic deposited state seem to be in a different amorphous form from the same metal melted down. There are 2 types of non-ferrous metals. There is the metal with only 1 microscopic constituent in it and the type with 2 or more constituents. The anti-corrosive properties of these 2 types are different. Take for instance 70/30 brass; this consists of 1 constituent only, and take 62/38 yellow metal which has 2 constituents. The replacement

of 1 per cent. zinc by 1 per cent. tin in the first makes a metal which will resist corrosion better than 70/30 brass. In yellow metal if you make it of chemically pure copper and zinc and make it into sheet and put it into a corrosive liquid the beta constituent begins to lose zinc until only practically copper is left, then this begins to react with the alpha constituent in electrolytic contact, and the zinc is dissolved out until the whole becomes practically copper. There are various ways of preventing this. The addition of .25 per cent. tin, .25 per cent. manganese, or 1 per cent. lead, obtained by the addition of a commoner spelter will give an alloy which will prevent the dissolution of the beta constituent and so long as the beta constituent is unattached the metal will not corrode.

Further down the scale we have the Delta, Sterro and manganese bronzes. These contain approximately 55 per cent. copper and 1 per cent. to 3 per cent. of tin, iron or manganese, either together or separate. Their anticorrosive properties are similar. In these alloys the beta constituent is present in larger quantities than in the yellow metal series, and it will hold in solution more tin, iron or manganese, the result is that these alloys are far superior to yellow metal alloys for withstanding, say, the corrosive action of acid mine waters.

The strength or hardness of metals has no relation to their resistance to corrosion by solution in acids or similar liquids. A soft metal will frequently withstand corrosive influences far better than a hard one; an example of this is lead, which will withstand the corrosive action of sulphuric acid even when fairly strong. This metal, however, is quite useless to withstand erosive action as distinct from corrosion. It is said that 2 per cent. lead in condenser tubes will last better than pure 70/30 brass and 1 per cent. lead in yellow metal sheathing will enable it to withstand corrosion in sea water better than yellow metal with only 0.3 per cent. to 0.5 per cent. lead. There are two probable explanations of this; it is possible that in the process of drawing or rolling a thin film of lead forms round the constituent crystals and prevents or checks the action of sea water; another explanation is that the lead is in small patches evenly distributed through the mass and this acts in electrolytic conjunction with the other constituents and thus hinders their corrosion, until it has itself been dissolved away. Which of these explanations is the correct one, we cannot say.

An example of lead in an alloy which is deleterious owing to erosive action, as distinct from corrosive action, is in gun metal fittings for steam boilers. We know of cases where the fittings had begun to leak seriously in a comparatively short time. Acid in the feed water was suggested, but an analysis disclosed the presence of a large percentage of lead in the metal. If it is at all possible lead should never be present in gun metal fittings for high-pressure steam boilers.

Corrosion set up by two dissimilar metals in contact with one another in a saline or acid solution is of fairly frequent occurrence, but it can always be avoided. Yellow metal should never be in contact with iron or gun metal as it sets up electrolytic action in acid, saline and even slightly alkaline solutions. Copper and iron should never be together under these conditions.

Certain alloys decay naturally without any apparent cause. Frequently this is due to the breaking up of the crystalline structure. Erosion and corrosion are the cause of loco tube failures, under the conditions under which they are used. A hard metal is essential to resist the erosive action of the fine ashes which are forced through the tubes almost like a sand blast. A metal is required which has a relatively high tensile strength at 250 degrees F. It is found by experience that arsenical copper is the best metal for this purpose. Copper containing about .07 per cent. phosphorus cast from crucibles from a mixture of electrolytic and B. S. copper gives a good tube, but it is not so favorably looked upon by engineers nowadays as the arsenical copper. Nickel alloys containing 2 per cent. nickel are sometimes recommended. We believe that nickel-copper alloys are used successfully for stay bolts in locomotives. The causes of corrosion and erosion are fairly well known and if the whole circumstances are known, competent chemists can find out the cause of any ordinary case of corrosion.

Edwin Lewis.

METALLURGICAL ABSTRACTS

SUBSTITUTE ALLOYS.

A New Perspective in the Making of Alloys.

By K. Friedrich.

Within the solidification and fusion point interval whose extension is dependent upon the relative quantity and the nature of the components, the alloy consists of a fluid and a solid portion. If the proportion of both are in accord then a mass also can be obtained that is plastic and pliable. If a material of a higher melting point is now added, this works in the pasty elementary matter increases the intimacy of the mixture, perhaps still by pressure with the application of a measured pressure and allowed to cool off, then there results an alloy, permeated throughout with foreign bodies, unless these previously in a homogeneous solution were carried in with it.

Such substitute alloys could find adaptation for the preparation of similar metallic materials of perhaps particularly small conductivity for heat and the electric current, while to the basic alloy a bad conductor was added. Then it allows the production of hardness in a graduated manner, as until now this was impossible, by the addition of quartz, corundum, carborundum, etc. Furthermore, with the aid of experiences of mixtures like terraza one can produce with metallic menstruum as useful, ornamental and tasty objects with suitable color effects. Finally, the method offers perhaps also the possibility of dispossessing costly constituents by means of cheaper materials in the composition of alloy. In other words, the object aimed at is to produce a composition, not strictly an alloy, which shall contain metallic and non-metallic substances combined in such a way as to obtain a plastic body and possessed of a metallic luster or effect.

Employment of aluminum for the preparation of alloys for pillow blocks and bearings (from *Revue Electrochemie et d'Electrometallurgie*, Vol. 4. No. 5, May, 1910). According to the Electricien there has been obtained an excellent alloy in melting together in suitable proportions the six following metals: Aluminum, antimony, copper, tin, lead and zinc. Not only does such an alloy diminish the friction, but its grain is such that it is much more resistant than the bronzes ordinarily employed.

In order to obtain this alloy the copper in the first place is melted, then there is added successively the other metals. At each addition of new metal, it is mixed energetically by

means of a bar of iron, and the fire is allowed to deaden a little. Towards the end of the operation the mixing is no longer done with a bar of iron, but with a willow or elder stick of wood, which, by means of the gases disengaged, reduces the oxides which are formed.

The proportions which make the best alloy are as follows: Copper 1.21 per cent, tin 12 per cent, lead .80 per cent, antimony 14 per cent, aluminum 35 per cent, zinc 37 per cent. These quantities can be modified in accordance with the employment for which they are destined. The extreme limits of the mixture are: Copper .40 to 1.25 per cent., tin 10 to 15 per cent., lead .60 to .85 per cent., antimony 6 to 20 per cent., aluminum 15 to 35 per cent., zinc 30 to 55 per cent.—C. P. K.

THE FORMATION OF ALLOYS BY COMPRESSION OF POWDERED METALS.*

Alloys are actually obtained as is known by the fusion of two or more metals. In cooling these metals crystallize only, or after they have been combined with one another. Certain investigators have endeavored to manufacture, if possible, the alloys by the compression of the metals in the form of powder, filings, etc. Prior to 1882, W. Spring had shown that the powdered metals which compose the alloys of Rose and Wood when compressed under a pressure of 5000 atmospheres gave a mass which at the point of fusion differ but little from that alloy obtained by the ordinary method. In 1881 Halleck showed that the simple mixture at ordinary pressure gives a composition more fusible than the most fusible of either metal constituent.

Spring has been able to obtain by the compression of powdered zinc and copper a kind of brass, but richer than the ordinary alloy. More recently this work has been resumed by Mr. Masing. At 4000 atmospheres he verified the statement that the mixed filings of two metals no longer gives neither a chemical combination nor a mixture of crystals.

The microscopical examination shows all kinds of metals to be absolutely distinct (the chemical combinations and the mixed crystals which characterize the alloys obtained by the fusion process). But if afterward, the conglomerate mass thus obtained is heated below the fusion point of the more fusible one of the two metals, there is obtained a mass more coherent, resembling rather obviously the composition of the veritable alloy; that is to say, its texture shows the mixed crystals very clearly.

C. P. K.

*Le Génie Civil. No. 4. P. 77-78. 1909—abstracts from Le Mois Scientifique et Industriel. P. 62, May, 1910.

SIDE LIGHT IN PLATING COSTS

To the Editor of The Metal Industry:

The conclusions of your correspondent, Mr. Barbour,* as to the costs of nickel plating are based on premises that any one having the least scientific acquaintance with nickel plating knows to be false.

It is false to say that nickel ammonium sulphate contains so small a percentage of nickel as your correspondent suggests. I have examined dozens of samples of the "commercial" article, and always found the nickel value to be very close to the theoretical.

And again, your correspondent seems to be woefully ignorant as to the anode efficiency in the nickel ammonium sulphate bath. I would recommend him to consult the work on this matter that has been done by his own countryman, Mr. I. W. Brown.

I would not trouble you with this letter were it not that I am interested in the education of electro-platers, and I think that such gross misstatements as those of your correspondent ought, in the interest of platers, to be at once corrected. These may not all be in a position to estimate the ignorance of your correspondent at its proper value.

W. E. Hughes,
Examiner in Electro-Metallurgy to the City and Guild of London Institute.
London, England, May 30, 1914.

*The Metal Industry, April, 1914.

NEW BOOKS

TRANSACTIONS OF THE AMERICAN INSTITUTE OF METALS.—Volume Seven. 1913. Size 6½ x 9 inches. 381 pages, together with 88 pages which contains bulletins Nos. 20 to 26. Bound in cloth. Published by the American Institute of Metals. Edited by W. M. Corse.

This Volume Seven of the transactions of the American Institute of Metals contains the proceedings of the Institute at the seventh annual meeting held in Chicago, Ill., October, 1913, and is by far the largest and most important work that the Institute has ever got out. The work itself, aside from containing the reports of the officers and committee connected with the Institute, furnishes a wealth of knowledge set forth in the papers and discussion presented at the annual meeting. These papers, which are hardly without exception written by practical men, give the results of experiments and working tests made in every-day practice and are particularly valuable for this reason to metal workers. Discussions of these papers which took place at the various sessions of the meeting bring out the most valuable points covered by the papers and are reported in the proceedings "verbatim." One might almost imagine himself at the sessions by simply reading the reports of these discussions and we are sure that every member of the Institute, by carefully studying this book, cannot fail to get a great deal of information from it. This work is accessible to non-members of the Institute by purchase from the secretary.

CHEMICAL REAGENTS AND THEIR PURITY TEST.—By E. Merck, translated by Henry Schenck. Second edition. 1914. Size 6¼ x 9¼ inches. 200 pages, including index. Bound in cloth. Published by D. Van Nostrand Company. Price $1. For Sale by THE METAL INDUSTRY.

This work, which is the second edition, does not depart essentially in its method of treatment from the previous one. Since the first edition of the work appeared, numerous articles have come into prominence as reagents, however, and new uses have been found for chemicals long part of the laboratory equipment, so that, besides the introduction of entirely new subjects, additions and changes have also been made in the text of the earlier edition. Frequently, too, these changes have materially raised the standard of purity. Coincident with this improvement is the inclusion among the references of important new contributions upon the uses and methods of testing reagent chemicals.

TRANSACTIONS OF THE INSTITUTE OF METALS. Number One, Volume Eleven. 1914. Size 6 x 8½ inches. 438 pages, including index. Bound in cloth. Published by the Institute of Metals. Edited by G. Shaw Scott.

This work includes the minutes of proceedings of papers presented at the annual general meeting of the Institute at Storey's Gate, Westminster, S. W., England, March 17 to 18, 1914. There is also included in the book in section two abstracts of the papers relating to the non-ferrous metals and the industries connected therewith, which have been published in trade journals and by societies for the current year. The work contains a complete list, alphabetical and classified, of the members of the Institute.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

ALLOYING

Q.—I wish to make the following alloy, so will you kindly inform me of the composition if possible.

(1) Elastic, hard and strong copper alloy for making socket of electric lamp, switch for electrical purpose, and various springs. I will make this in sheet and band form.

(2) Hard elastic and strong copper or copper-zinc alloy for making traveller of spinning. I will make this wire form.

A.—(1) Sockets for electric lamps are usually made of sheet yellow brass copper, 62; lead, 2½; zinc, 35½. Switches are made from hard, pure, rolled copper (10 harness). Springs, from strap phosphor bronze, copper, 95.45; tin, 4.50; phosphor, .05.

(2) Would suggest that you try copper, 96; aluminum, 3½, and aluminum vanadium, ½. Phosphor bronze (as above) may also answer.—J. L. J. Problem 1,994.

CASTING

Q.—Will you kindly answer the following question? In running a certain brand of white metal I encounter great trouble by finding numerous holes between the core and the shells to be lined. The only conclusion I can form is that gases occur when the metal is cooling. I may as well add that the metal has to be poured slightly under the tinge of red, and I warm both core and shell.

A.—As your lining metal seems to have a rather high melting point it is likely that the holes referred to are due to included air rather than gas. Steel mandrels should be used, and they should be given a thin coating of clay wash. In pouring the metal a steady pouring stream should be maintained and splashing avoided.—J. L. J. Problem 1,995.

CONDUCTIVITY

Q.—We wish some information as to the conductivity of metals in respect to heat. Specifically advise us the metal of which a pan should be made in order to attain the boiling point of water therein in the quickest possible time. We notice that when using a granite pan water will boil much more quickly than when a copper pan is used, everything else equal. Will you kindly explain this to us and advise if there is any way by which a copper pan may be used to attain as good results as with a granite pan.

A.—The coefficient of conductivity of heat for copper is .7189; aluminum, .3435; wrought iron, .2070; granite, .0051; glass, .0011. Water boils quickly in the enamel pan because the enamel prevents the escape of heat. Covering the copper pan with an insulated lid and insulating the sides would make it boil the water more rapidly.—J. L. J. Problem 1,996.

DEPOSITING

Q.—I should be glad if you could let me have a formula for depositing platinum.

A.—The following formula is given for a platinum solution: Dissolve 1 ounce of chloride of platinum in 2 quarts of water to which is added 8 ounces of 50% phosphoric acid. Stir thoroughly and add 26% aqua ammonia until the solution is neutral to blue litmus paper test. Now dissolve 6 ounces of phosphate of soda in 2 quarts of water and add to the first solution and mix. Boil the solution until the odor of ammonia has disappeared and then it is ready for use. Use 3 to 4 volts with platinum anodes. It is advisable to first give the articles a very light flash in the regular nickel solution as platinum deposits more even upon such a surface.—C. H. P. Problem 1,997.

HARDENING

Q.—We desire to harden steel tube about 1 foot long by 1 inch inside diameter and 1¼ inches outside diameter. The great difficulty we have in this hardening operation is the springing out of shape of the tube. Can you advise us or suggest any method of holding or handling a piece of steel tubing during the hardening process, that will overcome this trouble? We want to harden the steel tubes without changing their shape.

A.—Your problem is a rather difficult one. To prevent warping during heating you might heat the tube on a mandrel. If the tube only has to be hard on the outside you can obtain a compound that will probably prevent the warping.—J. L. J. Problem 1,998.

MIXING

Q.—What is the best method to use in mixing plaster of paris for patterns and general use. Also what to use to prevent it from setting too quick.

A.—There is a good old rule of thumb method that plaster should be mixed with water to the consistency of cream, but it has been found by experiment that from 10 to 12 parts by weight of plaster to 8 parts of water produces the strongest casts. Plaster should be shaken into the water in a large bowl, stirred gently and poured quickly. Too much stirring weakens the plaster or the addition of more plaster or water after mixing.

Lime water, ammonia or sulphate of zinc can be used to retard the setting of plaster; lime water being the material mostly used and added to the water before using. The lime water also strengthens the work.—P. W. B. Problem 1,999.

OXIDIZING

Q.—Kindly advise me how to obtain an oxide on brass to be used with a current and what anode to use. I want a glossy black to match patent leather.

A.—The following formula will produce a very glossy black nickel deposit that will closely imitate patent leather.

Water	1 gallon
Double nickel salts	6 ounces
Potassium sulpho cyanide	4 ounces
Sodium bisulphite	2 ounces
Copper carbonate	2 ounces
Ammonium carbonate	2 ounces

To prepare the solution mix the three first ingredients in two-thirds of the water (preferably warm) and the copper and carbonate of ammonia in the remaining third; then mix thoroughly. Use a half to 1 volt, but if this current is exceeded the deposit will be gray. Use regular nickel anodes and keep the solution neutral to test paper by adding ammonium carbonate or a little 26% water ammonia. Best results are obtained from black nickel solutions if the articles are merely flashed in a white nickel solution. This will give a better surface for the black and prevents staining which frequently occurs when the black nickel is deposited directly upon the brass.—C. H. P. Problem 2,000.

PLATING

Q.—Can you give me a formula for silver plating carbon springs without first copper plating them?

A.—There are two methods that you may persue in steel plating carbon springs without copper plating them. We presume you want to overcome the old difficulty in plating such springs, which frequently crack during the plating operations.

The first would be to cleanse them by scouring, using pumice stone and water. After they are scoured let them remain in a soda water solution until ready for plating. Do not immerse in strong acids. After cleansing wire a frame up and nickel plate for a short period, say from ten minutes upwards. Have previously prepared a silver strike. This to consist of a half ounce of chloride of silver and 2 ounces of cyanide of potassium to each gallon of water. Use fairly good sized silver anodes. Run your current direct, as it is hardly necessary to have a switchboard for this purpose. The striking solution should be of sufficient size so that the articles can be well covered. After nickel plating, wash in cold water and immerse in the silver strike with a good strong current for a few minutes. The articles should come from the strike solution with a brownish tinge and the solution should gas freely. Now remove and place in your regular silver bath until sufficient silver is deposited, unless you want a very light deposit that your articles can be taken directly from your strike. They will whiten up if the current is turned off before removing from the bath.

If you wish to avoid the nickel plating then be particular in cleansing the springs and deposit the silver directly upon them from the strike solution and finish, if necessary, in your regular bath.—C. H. P. Problem 2,001.

Q.—Will you please give me a formula for a zinc plating solution?

A.—The following formula for zinc plating or electro-galvanizing gives excellent results:

Water	1 gallon.
Commercial sulphate of zinc	1½ to 2 lbs.
Commercial sulphate of alumina	2 to 4 ounces.
Common salt	2 to 4 ounces.
Common black molasses	1 ounce to each 10 gallons of solution.

The solution should be prepared in the regular manner by dissolving the salt in luke warm water in the order given. When the tank is set up place the anodes in it. These should be of pure cast zinc made from Bertha or prime New Jersey spelter.

Let the solution stand for 12 hours. The action of the solution upon the anodes will neutralize any free acid that it may contain. Use a voltage of not less than six volts and amperage according to the amount of working surface to be plated. Galvanizing solutions require a considerable larger amount of amperes per square foot of surface than any other metals to be deposited.

Articles of iron should be cleansed in the usual manner as for other deposits. They may be plated direct or the surface may be previously lightly coated with brass, copper or nickel. The time of immersion depends upon the thickness of metal required and the time occupied may be from 15 minutes to 1 or 2 hours. —C. H. P. Problem 2,002.

POLISHING

Q.—What is the average amount of quantity of compression bibb bodies that a polisher can finish in a ten hour work day, using canvas and felt wheels.

A.—The average output of a polisher working ten hours per day on ½ inch plain compression bibb bodies should be from 175 to 200 complete bodies per day. If the goods are made from yellow brass he will be able to polish 200, and if the castings are of red brass, 175. This is owing to the fact that red brass is harder than yellow.—P. W. B. Problem 2,003.

REFLECTING

Q.—Kindly let us know whether there is any way by which a metal may be polished or polished and treated so that the lustre is not affected by heat. We have been experimenting with a nickel-plated reflector to reflect heat and wish to overcome the effect of the heat upon the brightness of the polish, the heat being 600 degrees F.

A.—To keep a reflector bright at 600 degrees Fahrenheit you will have to keep the air away from it. Would suggest that you try "liquid silver" on porcelain.—J. L. J. Problem 2,004.

RUST-PROOFING

Q.—I have recently started to rust-proof some articles of sheet steel and am using the method known as "Cozlettizing" and do not seem to get the proper results.

First—The articles are not absolutely rust proof.

Second—It takes from two to three hours to accomplish this, which seems too long.

Third—The solution evaporates very fast.

The mixture is as follows:

Con. Phosphoric Acid	½ gal.
Water	½ gal.
Iron filings	2 lbs.

These are dissolved first and then put into an iron tank with 50 gallons of water, which is kept at boiling point when in operation. Would be pleased to get some information on the above points.

A.—(1) There is no finish known that is absolutely rust-proof. Coslettizing is regarded as being sufficiently rust-proof for a large variety of work. Treating iron and steel by the Bradley or Bontempi processes is considered the best method for rust-proofing. In using these processes the work is specially treated in a muffle furnace employing about 900 degrees Fahr. or more. It is not adapted to all classes of work as the temper is destroyed and the article somewhat enlarged.

(2) The operation cannot be accomplished in less than two hours as the coating would not be heavy enough. Leaving the work in the solution for three hours is still better as a heavier deposit is produced.

(3) The evaporation of the solution of course cannot be prevented. It should be kept a little below the boiling point and the evaporation will be much slower. The solution you use is correct and the process is patented.—E. B. Problem 2,005.

SOLDERING

Q.—Will you kindly inform us what is used in solder manufacture to clean the metal so as to ensure a bright surface?

A.—To bring up the dross and get a good clean metal, immerse a few potatoes in the metal by the aid of an iron wire sieve basket weighted with iron or by some other method. The steam generated will bring the dross to the surface and purify the metal. Skim the dross from the surface before pouring. Any potatoes that are not fit for eating purposes will give results.—C. H. P. Problem 2,006.

STRIKING

Q.—Kindly advise me of a good formula for a strike solution on brass and German silver articles.

A.—You do not state in your inquiry the nature of the strike you require, but we presume you refer to a silver strike. To prevent local action of the strike upon brass, it will be necessary for you to previously lightly nickel plate or amalgamate the brass surface with a mercury dip previous to the silver strike. We also give you a formula for the mercury dip.

Silver Strike:

Cyanide of potassium or sodium	8 to 10 ounces
Chloride of silver	½ ounce
Water	1 gallon

or Trisalyt silver may be used for the purpose as follows:

Silver Trisalyt	1 ounce
Cyanide of soda	6 to 8 ounces
Water	1 gallon

Use 2 to 3 volts for strike solution. The anodes may be copper or copper and silver. If copper anodes are used exclusively, silver in the form of chloride or Trisalyt will have to be added whenever the strike deposit shows a pinkish tone.

For the mercury dip, use the following proportions:

Yellow oxide of mercury	¼ ounce
Cyanide of potash or soda	6 ounces
Water	1 gallon

This is used only as an immersion dip before the silver strike. If at any time the brass articles should show cracks after plating, the strength of the solution should be reduced at least one-third. —C. H. P. Problem 2,007.

PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

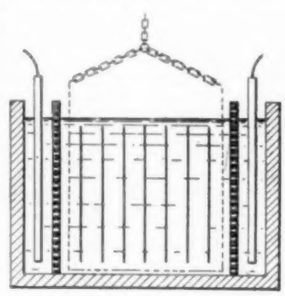
1,098,137. May 26, 1914. **Alloy.** C. P. Van Gundy, Catonsville, Md.

This invention relates to the production of an alloy containing as principal and characteristic constituents aluminum, zinc and lead, and which, while adapted for general use where light, strong castings are required, is especially adapted for use where subjected to high temperatures, as, for instance, in the case of packing rings for pistons of locomotives using superheated steam.

An alloy having the characteristics of lightness, strength and a high melting point may be obtained by combining the constituent elements in the following proportions: Aluminum 85 per cent. to 87 per cent., zinc 9 per cent. to 11 per cent., lead 2 per cent. to 4 per cent., copper (or nickel) 1 per cent. to 3 per cent. The percentages of the several elements which have been found most efficient and economical are, however, the following: Aluminum 86.5 per cent, zinc 9.7 per cent., lead 2.5 per cent., copper 1.3 per cent.

1,098,338. May 26, 1914. **Cleaning Metal Surfaces.** C. H. Thompson, Stourbridge, England.

During the manufacture of many forms of metal articles it is necessary to subject the surfaces to a cleaning operation. Some articles, such as baths and other hollow-ware, sheets and tubes of iron, steel and copper, require to be cleaned before they can be properly enameled, galvanized or plated. And other articles require to be cleaned after heating or annealing before a shaping or like operation can be performed thereon.



This invention relates to the cleaning of such metal surfaces in an electrolyte.

The invention comprises the employment of a bath of any suitable chloride, sulphate or nitrate solution, passing an alternating current through such bath, separating the electrodes from the articles to be treated by perforated or porous partitions, and placing the articles in the bath without any metallic connection with the electrodes.

The articles to be treated are simply placed in the bath in such a manner that they are not connected metallically with the electrodes, as shown in cut. In the case of sheets or tubes these may conveniently be mounted on a wooden cradle which can be lowered into the bath. In fact, it is a convenience to mount all other articles in this way for the reason that not only is the moving of the articles into and out of the bath facilitated, but it is also rendered possible to keep the articles in a state of motion within the bath, for example, by swinging the cradle or imparting to it a regular up and down movement.

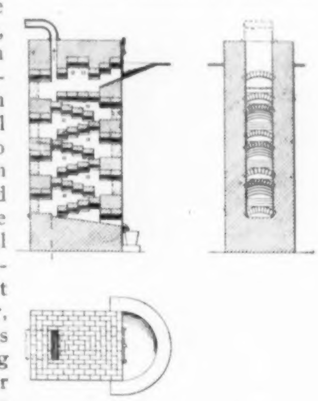
1,096,655. May 12, 1914. **Platinum Alloy.** Ezechiel Weintraub, of Lynn, Mass. Assignor to General Electric Company, a corporation of New York.

The present invention comprises new and useful alloys of platinum and either tungsten or molybdenum, or of the three together, having the property of being malleable, resisting oxidation and having besides greater mechanical strength than platinum.

The inventor claims: A malleable alloy comprising about 20 to 60 parts of platinum and about 80 to 40 parts of tungsten, said alloy being characterized by permanence in air and by being more refractory and harder than platinum.

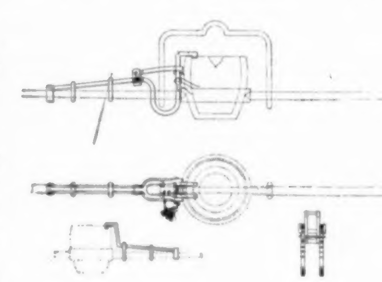
1,095,135. May 19, 1914. **Process of Separating and Recovering Volatile Matter.** Grenville Mellen, East Orange, N. J.

A specific application of this invention is in the treatment of alloys containing one or more volatile elements; for example, scrape brass may be melted and poured in a hopper, from which it will flow through a gate to the combustion chamber, as shown in cut, in which a part of the zinc content will be distilled off and oxidized to zinc oxide, which will mix with the products of combustion and pass out through a channel. The residue of molten brass will flow over a support to the cascade supports below, where it will be further heated by burner, and the ascending heated gases from lower burners, distilling out and oxidizing a further quantity of zinc, the vapors passing off with the products of combustion as in the combustion chamber This treatment is repeated by flowing the molten metal over all the supports in cascade, resembling a succession of waterfalls until the final product leaves the furnace at the bottom through an outlet and is collected in any suitable receiver.



1,098,470. June 2, 1914. **Adjustable Holdback for Crucibles.** Herman Beulke, of New Castle, Pa., assignor to American Car and Ship Hardware Manufacturing Company, of New Castle, Pa., a corporation.

This invention relates to new and useful improvements in supporting devices and more particularly to a supporting device or holdback for crucibles, used in connection with machines or devices for pouring molten metal and the primary object of the device is to provide an improved holdback which is capable of application to crucibles of various sizes.



A further object of the invention resides in providing a device which may be quickly and readily applied to any shank used for supporting crucibles and a still further object resides in providing a device which is simple and durable in construction, inexpensive to manufacture and one which will be very efficient and useful in operation.

With these and other objects in view, the invention consists in the novel features of construction, combination and arrangement of parts, as shown in the cut.

1,098,404. June 2, 1914. **Method of Welding Copper.** E. E. Reigle, Baltimore, Md., assignor of one-third to John Zajic of the same.

This invention relates to a method of welding metals.

The object of the invention is more particularly to provide a method of welding copper.

The inventor says:

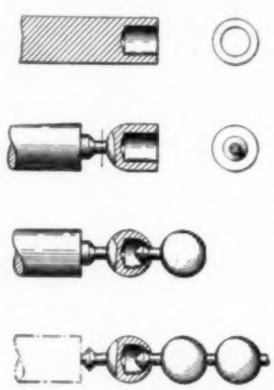
"An efficient method of welding copper has long been sought, but so far as I am aware, no practicable method is now known for accomplishing this object.

"In carrying out the invention I take the metal to be welded and boil it in a strong solution of chlorate of potash for about two hours. As before stated, I then find that the copper may be cold welded without any trouble and the resultant union of the metal will be complete.

"While I have found that boiling the metal in chlorate of potash, for the time stated, efficiently accomplishes the desired object, it is possible that subjecting the metal to the action of chlorate of potash in the presence of heat would secure the desired result, and I wish it to be understood that the present invention contemplates such procedure and that it is not limited to the precise method outlined.

1,098,597. June 2, 1914. **Chain Construction.** F. A. Taylor, Waterbury, Conn.

This invention relates to an improved chain construction, the object of the invention being to provide a very simple and strong construction which may be employed with effectiveness for chains of small sizes, as shown in the cut, such, for example, as used with the so-called "pull sockets" for incandescent electric lamps. The construction is likewise such that long lengths of chain may be made from ordinary small rods of brass or any other suitable material.

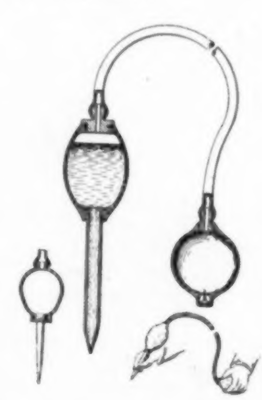


The patent covers: In a chain of the character described, a link comprising a seamless hollow body open at one end, a ring-like contraction being less than the diameter of the interior space, a shank projecting from the opposite end of said body, and a head on said shank spaced away from said body, said body, shank and head being integral, the side walls of said body being relatively thicker than the thickness of said ring-like contraction.

1,099,344. June 9, 1914. **Instrument for Writing, Marking, or Decorating with Plastic Materials.** Edward B. Desenberg, of Kalamazoo, and Edward S. Pilsworth, of Battle Creek, Mich.

This invention relates to an improved instrument for writing, marking or decorating with plastic materials.

The main object of the invention is to provide an effective device of the character described, in which the surplus of any hardened material can be readily removed so that the instrument can be readily charged again.



Objects pertaining to details and economies of construction and operation will definitely appear from the detailed description to follow.

The objects of the invention are accomplished by the devices and means shown in the cut.

In use the reservoir bulb is filled with a preparation of plaster of Paris in liquid form, which is mixed with a suitable retarding agent, as alcohol or glycerine, to delay the hardening of the same. The writer takes the pen in hand and by gentle pressure on the bulb with the other hand forces air against the contents, delivering the plastic material in a stream of any desired velocity. A fine line or a coarse line can be drawn by simply varying the speed of the movment of the pen, or the pressure within the reservoir, or both.

1,098,608. June 2, 1914. **Enamel Lacquer, a Varnish.** Jonas W. Aylsworth, of East Orange, N. J., assignor, by direct and Mesne Assignments, to Condensite Company of America, of East Orange, N. J., a corporation of New Jersey.

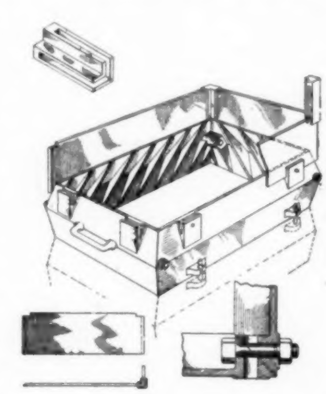
This invention contemplates such an enamel as is adapted to be formed on metals and wood, to form a hard surface on cardboard, fabric, paper, leather, etc., to form a surface adapted for embossing operations, making negative matrices for engraving and printing, forming a hard surface suitable for molding sound records, and incorporating with various inert pulverized materials and pigments to form veneers for wood. It also is adapted to be incorporated with woven fabrics or paper to form bindings for books, and in the manufacture of a variety of articles.

The invention comprises broadly a fusible resin of phenolic origin, which has mixed therewith a substance which is adapted to react with the resin upon the application of sufficient heat to form a hard insoluble condensation product.

More specifically, the invention comprises a varnish resin which is soluble in the usual solvents of shellac, and which may range from pale amber to various shades of transparent brown in color, and which hardens on the application of heat at a temperature of from 170 to 220 degs. F., or higher. The varnish upon heating, as described, forms a refractory enamel more refractory than ebonite or hard rubber, and almost equaling ivory in hardness and strength. It is at the same time more capable than are the substances mentioned of withstanding the action of chemical agents and heat.

1,100,049. June 16, 1914. **Molder's Flask.** Otto R. Berger, Cleveland, Ohio.

This invention relates to molders' flasks, which may be constructed of separable side and end members so that the flasks may be made up for any desired size of casting without having a separate flask for each size.



The principal object of the invention is to provide a flask of this class which may be readily assembled and taken apart, and which is effective and efficient in operation.

Another object of the invention is to form the members, of which the flasks are constructed, with inclined transverse ribs.

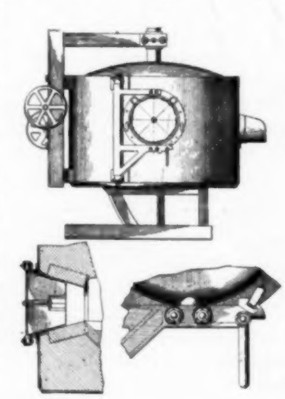
A still further object of the invention is to provide perforated aligning lugs, which are slotted, to prevent the perforations from becoming clogged.

A still further object is to provide means for forming an extension of a flask of the class described.

For the attainment of these ends, and the accomplishment of other new and useful objects, the invention consists in the features of novelty in the construction, combination and arrangement of the several parts generally shown in the accompanying drawing.

1,100,994. June 23, 1914. **Door for Electric Furnaces.** F. T. Snyder, Oak Park, Illinois.

This invention relates to doors for electric furnaces, and its object is to provide a door of simple construction, which will act as a plug to close the charging opening to the furnace and which can be adjusted to accurately fit such opening. One feature of the invention consists in the construction of the door itself, as shown in the cut.



Another feature relates to the manner in which the door is mounted upon its hinges, whereby the door, as it is swung open, may also be rotated about a vertical axis and may thus always be maintained in such position that the outer face of the door is turned toward the workman who opens the door.

The invention also provides means whereby the door may be adjusted upon its hinges so as to be brought into true alinement with the charging opening.

NEW PLATING ROOM INSTALLATIONS

By Charles H. Proctor.*

When installing new plating room equipment or adding to the old the same careful consideration should be given to the material to be used in the plating baths as you would to, the dynamos, mechanical plating barrel or mechanical plating tank and other mechanical equipment necessary in a modern and up-to-date plating department.

Unfortunately and often times unwisely the very essential part of the plating room has been overlooked, that is, the solutions. It is from the plating solution you expect to get the returns that pays you for your investment. The materials should go into solution upon the most economic basis, for from these materials you must obtain your profits. Then why not be as careful in considering your chemical equipment as you would your electrical and mechanical? In the past thousands of manufacturing concerns have neglected this most important matter and still continue to use the carbonates and chlorides of metals that cost at least twenty-five per cent. more in cyanides than the more efficient metal cyanides to maintain them in solution. It is the elimination of the carbonates and chlorides that produce this saving of one-fourth of your investment in cyanides. Is this amount worth saving in these modern days of competition?

Not only is there a saving in the cost of cyanides, but the elimination of inert material from your solutions enables you to produce a more rapid deposit, because you also eliminate more than twenty-five per cent. of your internal resistance. Solutions made up from the metal cyanides can be run at a lower voltage and consequently a higher amperage than with solutions made up from carbonates or chlorides of the metals. Higher amperage means more rapid deposits. Silver cyanide consists of 80½ per cent. pure silver and 19½ per cent. cyanogen, the active principle of cyanide; copper cyanide consists of 70 per cent. pure copper and 30 per cent. cyanogen; zinc cyanide consists of 55 per cent. pure zinc and 45 per cent. cyanogen.

In the use of metal cyanides only the active principles of the solution enter into its composition and when necessary to add additional agents as conductors very small amounts are only required for results. The following formulas will give a practical demonstration of the results that can be obtained and the saving in cost of preparing the various solutions made up from the metal cyanides. The density of the solutions may be increased by adding the materials prescribed proportionately.

Silver Solution.

Water	1 gal.
Cyanide of sodium, 2½ ozs., or cyanide mixture	3 ozs.
Silver cyanide	2 ozs.
Ammonium chloride	⅓ oz.

Specific gravity 3 deg. Baumé, metal content 1 61/100 ozs.

Copper Solution.

Water	1 gal.
Cyanide of sodium, 2 ozs., or cyanide mixture	2¼ ozs.
Copper cyanide	2 ozs.
Ammonium chloride	⅓ oz.

Specific gravity 2½ degs. Baumé, metal content 1 40/100 ozs.

Bronze Solution.

Water	1 gal.
Cyanide of sodium, 2½ ozs., or cyanide mixture	3 ozs.
Copper cyanide	2¼ ozs.
Zinc cyanide	½ oz.
Ammonium chloride	⅓ oz.

Specific gravity 3 degs. Baumé, metal content 1 80/100 ozs.

Brass Solution.

Water	1 gal.
Copper cyanide	2 ozs.
Zinc cyanide	⅔ oz.
Ammonium chloride	⅓ oz.

Specific gravity 3 degs. Baumé, metal content 1 78/100 ozs.

The proportions given in the preceding formulas will give excellent results in still or agitated solutions. For mechanical barrels or mechanical tank solutions the proportions stated should be increased fifty to a hundred per cent. to give the required density and metal content for such solutions. In replenishing brass, copper or bronze solutions with metal cyanides, in solutions previously made up from the carbonates of copper and zinc, the following proportions should be used to equal the metal content of the carbonates of copper based upon a metal content of 50 per cent.:

Cyanide of copper (containing 70 per cent. metal and 30 per cent. cyanogen)	11 ozs.
Cyanide of sodium (containing 129 to 130 per cent.)	9 ozs.

These proportions will equal:

Copper carbonate (containing 50 per cent. metal and 50 per cent. sodium carbonate)	1 lb.
Cyanide mixture (containing 98 to 99 per cent.)	2 lbs.

The above figures, based upon average cost of material, will show a saving of 20 to 25 per cent. in replenishing cyanide solutions and eliminate 50 per cent. of density at each time additions are made of replenishing material. These figures should prove interesting when investing in chemicals for your solutions as a part of your equipment. A very large manufacturing concern whose output in brass plated steel goods is counted in tons is saving 42 per cent. in cost of replenishing brass solutions from the metal cyanides in its mechanical plating tanks over the method of using carbonates of the metals, which method you are probably doing in your plating department today. Does this saving appeal to you, Mr. Purchasing Agent? If so, request your plater to investigate the metal cyanides. He surely must concede that whatever metal salts he dissolves in cyanides must give cyanides of the metal in solution. Eliminate the sodium carbonates from your salts and use only the active principles necessary in your solution that is, metals and cyanogen, and you will obtain the results claimed in this article.

*Roessler & Hasslacher Chemical Company, New York.

MANGANESE

D. B. Browne, metallurgical engineer of the Goldschmidt Thermit Company, reports that the metal manganese is very largely used by manufacturers of nickel, monel metal, cupro nickel, German silver, nickel white metal castings, etc. The manganese used is what is technically called "Pure" manganese, which is really 98 per cent. pure and free from carbon. Manganese will not only flux the mixture, but it will have the tendency to improve the lustre of the castings and to brighten the metal.

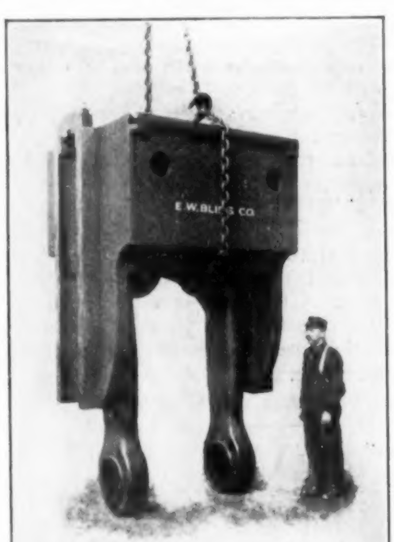
Pure manganese metal has a surprisingly low melting point. According to reprint 205 of the bulletin of the Bureau of standards, Washington, D. C., this melting point is about 1,255 degs. C. Moreover, manganese dissolves very readily in copper mixtures, so that there should be no difficulty whatsoever attached to introducing the pure manganese metal in practically any copper base. The Goldschmidt Thermit Company, New York, makes a specialty of supplying not only the pure manganese but various alloys.

LARGE DRAWING PRESS

The press, as illustrated in the various photographs shown, was recently designed and built by the E. W. Bliss Company, of Brooklyn, N. Y., and is one of the largest drawing presses ever built. It is of the tie rod construction in which all the working strain is taken by large vertical steel tie rods, and has an extreme height of about 40 feet and weighs close to 650,000

THE 325-TON BLISS PRESS.

pounds. A fair idea of the immense size of the press may be obtained by the comparative size of the men shown in the illustrations. The press was designed to draw metal shells as large as 48 inches in diameter. It will draw and lift out shells as deep as 40 inches and draw and push through shells 45 inches deep. When shells are lifted out, the positive bottom knockout which is stationary but adjustable for the different heights of

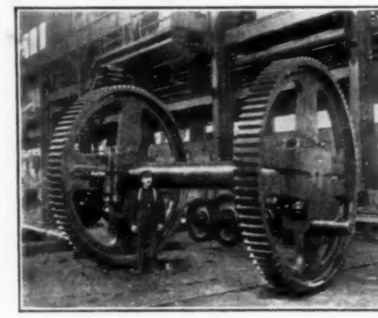


THE PLATEN FOR THE BIG PRESS.

shells is used. Blanks as large as 64 inches in diameter and 3/16 inch thick may be drawn.

The table carrying the die is operated by a powerful toggle motion which connects on to the two crank pins on the main gears. The plunger carrying the punch is operated by the steel cross head which is connected by two double connecting rods on to the crank pins on the main gears. The blankholder is stationary. The plunger and blankholder adjustments are each accomplished by independent electric motors, there being a separate motor for each adjustment. Before adjusting the blankholder is unlocked, and after adjusting is locked by an electric motor. All motors for adjusting are directly attached to the machine. The entire train of gearing is of steel with machine-cut teeth. The machine has three ratios of gearing, 200:1, 100:1, and 67:1. By means of change gears, the speed of operation may be varied from 1½ to 3 and 4½ revolutions per minute as may be required for the different classes of work to be produced.

The cross head and bed are counterbalanced by an hydraulic



THE GEARS OF THE BIG PRESS.

accumulator which may be placed above or below the floor line, nearby or in any suitable place from the press, as may be most convenient. The machine is driven by 200 horsepower electric motor and controlled by a powerful hand actuated friction clutch of the double grip type.

A SUBSTITUTE FOR PICKLING ACID

Ellwood Ivins' Tube Works, Oak Lane Station, Philadelphia, Pa., are offering to the trade "Edis Compound," developed in their mills during the past several years as a substitute for sulphuric acid in dipping or pickling brass, copper, German silver, steel and iron. In answer to an inquiry regarding this new material, Ellwood Ivins states:

"You know, of course, that after heating metal there is an oxide or scale that forms on it after it is cooled off, and so far as we know, for a great many generations sulphuric acid has been mixed with water, and the articles dipped or pickled in this solution, remaining there until the scale or oxide has been removed. Most of us manufacturers heat the acid to a point of about 180 degrees, which makes the acid act quickly. It is needless to say that the fumes given off from sulphuric acid are violent and give discomfort to the operators on the acid tubs, and I might say to the entire room in which the tubs are located. In addition to all this the fumes attack everything they come in contact with, ruining belting, rusting machinery and spoiling iron or steel by rusting them; in other words, it is the most disagreeable thing manufacturers of metals are obliged to use.

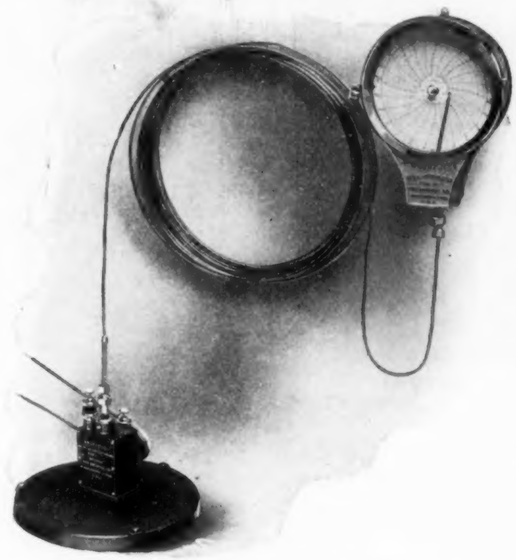
"Our Edis Compound is in a form of dry cakes which are simply dissolved in water and brought up to about 200 degrees temperature; in other words, it is used just about the same as acid, but being in the dry cakes it is very convenient and pleasant to handle, and does not start to act on anything until it is dissolved in water. It can readily be handled by one's bare hands. Now this material has the faculty of removing the scale in far less time than acid, and after the scale has been removed, it stops work, so to speak, and therefore leaves the surface of the metal without 'pits' but smooth. There are no objectionable fumes connected with it, and that is a big item. In short, it does the work that sulphuric acid accomplishes, but with all the nasty traits of acid removed, and, as we say, does it quicker.

"It is also cheaper. This compound we have used in our mill for a long time, and thought it too good to keep to ourselves, so we told some of our customers about it and agreed to supply it to them, so you see while this is its 'first appearance in public' it has really grown to middle age in our mill as one of our shop secrets."

Mr. Ivins will be glad to give further information and prices to readers of THE METAL INDUSTRY who are interested in this new pickling material.

PNEUMATIC RECORDING TACHOMETER

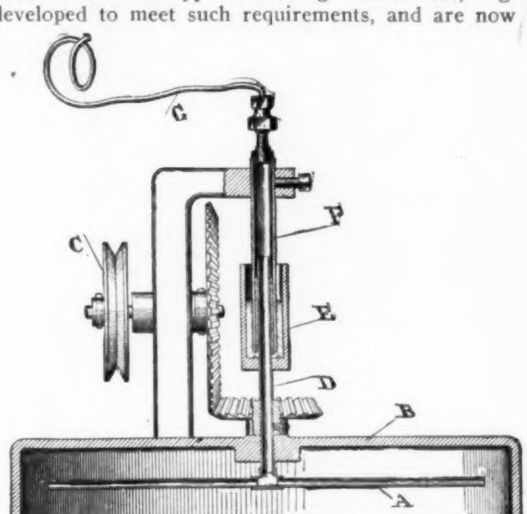
The field of usefulness for recording tachometers is almost unlimited because there is a great need for measuring and controlling the revolutions of shafting, machinery, engines, etc. In some processes in mills it is desirable to have a certain speed or rate of revolutions maintained continuously or certain stops made periodically, but not too often, and the recording tachometer provides the superintendent or manager with information about the actual operating conditions maintained. For instance, blast furnace blowing engines are driven at a certain



PNEUMATIC RECORDING TACHOMETER.

predetermined R. P. M., but are usually slowed up once every four hours at casting time.

Bristol's Pneumatic Type Recording Tachometer, Fig. 1, has been developed to meet such requirements, and are now exten-



SHOWING THE CONSTRUCTION OF THE REVOLVING MECHANISM.

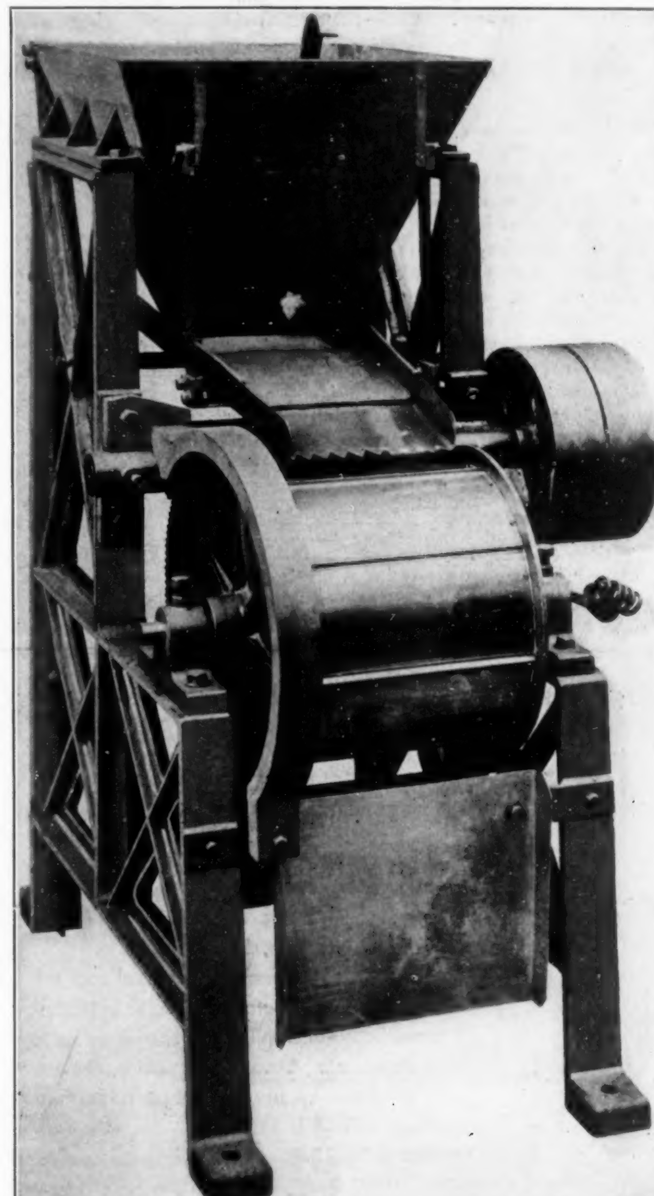
sively used in connection with blast furnace blowing engines and for similar applications such as for recording the speed of paper machines. The pneumatic principle of operation depends on the centrifugal action of air in a revolving tube which is connected to the recorder through a special oil seal and flexible connecting tube.

Fig. 2 shows diagrammatically the construction of the revolving mechanism. In the diagram "B" designates a hollow circular protecting base and at its upper surface is provided a bearing for a hollow shaft "D." This shaft is arranged to be rotated from any desired mechanism through a set of gears and pulleys (or sprockets).

These patented tachometers are manufactured by The Bristol Company, Waterbury, Conn.

MAGNETIC SEPARATORS

The earlier prejudice which existed against the employment of magnetic separators has gradually been dispelled by the more rational opinions arising from a practical acquaintance with good magnetic separating machines. There have been so many cases where magnetic separation could be used with advantage, that it is quite possible that such an adaptation has never occurred to those to whom it would be useful. The Rapid Magneting Machine Co., Ltd., 18, The Crescent, Birmingham, England, are manufacturers of a wide range of



THE RAPID MAGNETING MACHINE.

machines of this type, but those which would be of interest to our readers are such as would be employed in foundries, molding shops, machine shops, etc. For removing iron from all kinds of metal turnings the working of one of the latest models is described thus:

MAGNETIC SEPARATING MACHINE. NEW TYPE.

After passing through a ¼-inch sieve, the material to be separated is fed into the hopper, which can be adjusted to deliver from a few pounds to hundredweights per hour, according to the requirements of the material. The feed tray underneath is jigged sideways, and the delivery end being serrated, distributes in a regular and constant stream on to the whole width of the revolving brass drum, inside which,

radiating from the center, are electro magnets (fixed). The magnetic field extends round the front half of drum. On coming in contact the iron is seized by the magnets, and by means of the ridges is carried round to the back of machine out of the magnetic field, falling immediately by gravity. No cut-off or brush required.

While revolving, the iron jumps and gambols from magnet to magnet, thus releasing every particle of non-magnetic material.

The machine is automatic in action, as the hopper can be filled in the certainty that it will empty itself, and will successfully separate a mixture of 99 per cent. iron and 1 per cent. brass or copper, etc.—turnings or filings.

RHEOSTAT ECONOMIC EFFICIENCY

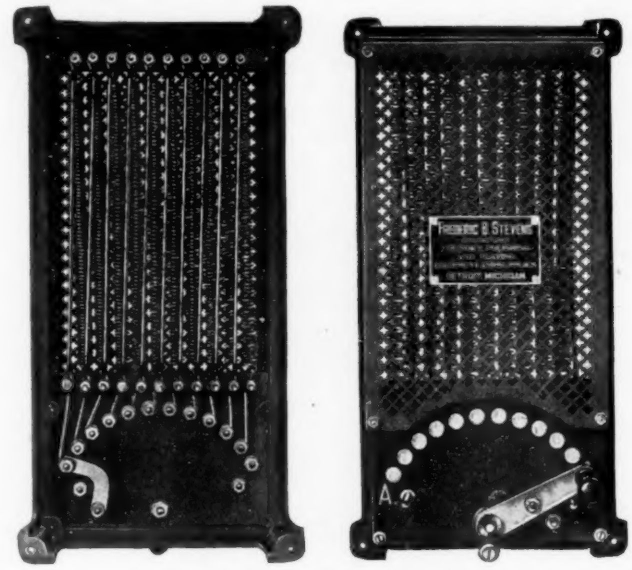
By F. B. Stevens.

When real economy is combined with real efficiency the most has been made of opportunity. The crying need in electro-plating has always been an accurate rheostat, one that is made to meet all conditions and with which the electrical current can be controlled to the fraction of a volt.

The Germans have finally supplied this long felt want and there is now imported into this country a rheostat, shown in cut, that will give the most accurate regulation. Even without a field regulating rheostat on the generator the current, with the use of one of these rheostats, may be cut down to ½ volt and regulated with absolute accuracy up to the full voltage of the machine. There is both economy and efficiency.

This instrument will be especially appreciated by silver and gold platers and in all departments of the plating business where accuracy and perfect regulation are necessary for economical and uniform work.

These rheostats are imported and for sale by Frederic B. Stevens, manufacturer of buffing compositions, polishers and



THE STEVENS RHEOSTAT.

platers supplies and equipment, foundry facings, supplies and equipment, of Detroit, Mich., and further particulars may be obtained from him.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE METAL INDUSTRY ORGANIZATIONS.

AMERICAN INSTITUTE OF METALS

President, G. H. Clamer, Philadelphia, Pa. Secretary and Treasurer, W. M. Corse. All correspondence should be addressed to the Secretary, W. M. Corse, 106 Morris avenue, Buffalo, N. Y. The objects of the Association are for the educational welfare of the metal industry. Annual convention with the American Foundrymen's Association in a succession of cities as invited. The next convention will be held in Chicago, Ill., September 7 to 12.

H. W. Gillett, chairman of the papers committee, reports that the following papers are expected to be presented at the September meeting:

JOINT PAPERS WITH A. F. A.

Safety First, F. W. Reidenbach, Genesee Metals Company, Rochester, N. Y. Health and Safety in the Foundry, F. Moerl, Pullman Company, Chicago, Ill. Scientific Management in the Foundry, F. A. Parkhurst, Aluminum Castings Company, Detroit, Mich. Differential Bonus and Scientific Management, F. A. Parkhurst, Aluminum Castings Company, Detroit, Mich.

PAPERS FOR AMERICAN INSTITUTE OF METALS.

Report of official chemist, A. D. Little, Inc., 93 Broad street, Boston, Mass. Report on Standardization of Crucibles, Committee. Report on Nomenclature of Alloys (G. K. Burgess), Bureau of Standards, Washington, D. C. Metallurgy of Zinc, Geo. C. Stone, New Jersey Zinc Company, 55 Wall street, New York City. Metallurgy of Tin and Antimony, W. A. Cowan, National Lead Company, 129 York street, Brooklyn, N. Y.

SYMPOSIUM ON ELECTRIC BRASS MELTING.

The Hering Furnace, G. H. Clamer, Ajax Metal Company, Philadelphia, Pa. Electric Furnace Tests, H. G. Dorsey, National Cash Register Company, Dayton, Ohio. Electric Brass Furnaces and the Central Station, H. M. St. John, Commonwealth Edison Company, Chicago, Ill. The Central Station and Electric Brass Furnaces, E. L. Crosby, Edison Illuminating Company, Detroit, Mich. Metal Losses in Electric Brass Melting (H. W. Gillett), Bureau of Mines, Ithaca, N. Y.

INDUSTRIAL PAPERS.

Die Casting, C. Pack, Doehler Die Castings Company, Brooklyn, N. Y. Die Cast Aluminum, C. B. Bohn Aluminum Castings Company, Detroit, Mich. Some Electric Furnace Products in the Foundry, T. B. Allen, Carborundum Company, Niagara Falls, N. Y. Drop Casting of 88-10-2, E. A. Barnes, Fort Wayne Electric Works, Fort Wayne, Ind. Bull Run Talc, J. L. Jones, Westinghouse Electric and Manufacturing Company, E. Pittsburgh, Pa. Cores, H. M. Lane, 18 Piquette avenue, Detroit, Mich. Recovery of Waste Metal, American Concentrator Company, Weightmann Building, Philadelphia, Pa. Metallography in the Study of Some Cu-Sn-Zn Alloys, Professor S. L. Hoyt, University of Minnesota, Minneapolis, Minn. New Methods of Zinc Analysis, Professor G. E. F. Lundell, Cornell University, Ithaca, N. Y. New Methods of Testing Aluminum, A. B. Norton, Aluminum Castings Company, Detroit, Mich. Effect of Repeated Melting on Non-Ferrous Alloys, F. O. Clements, National Cash Register Company, Dayton, Ohio. Brinnell Hardness of Non-Ferrous Alloys, V. Skillman, Lumen Bearing Company, Buffalo, N. Y. Gun Metal Test Bars (G. K. Burgess), Bureau of Standards, Washington, D. C. Care and Conversion of Rolling Mill Scrap, W. W. Rogers, Riverside Metal Company,

Riverside, N. J. A Brief Visit to a Brass Rolling Mill, E. J. Gutsche, Detroit Copper and Brass Rolling Mills, Detroit, Mich. Non-Ferrous Alloys for Automobile Construction, E. B. Horne, Packard Motor Car Company, Detroit, Mich. Aluminum Solders, W. Arthur, Research Laboratory, General Electric Company, Schenectady, N. Y. Chromium Plating, G. J. Sargent, Morse Hall, Ithaca, N. Y. Recent Applications of Metallic Cobalt, D. B. Browne, Goldschmidt Thermit Company, 90 West street, New York City. Some Furnace Tests, F. L. Wolf, Ohio Brass Company, Mansfield, Ohio. Producer Gas for Melting Yellow Brass, E. S. McClelland, Westinghouse Machine Company, East Pittsburgh, Pa. Pyrometers for Use in Molten Brass (H. W. Gillett), Bureau of Mines, Ithaca, N. Y.

AMERICAN ELECTRO-PLATERS' SOCIETY

(AN EDUCATIONAL SOCIETY.)

President, J. H. Hansjosten, Kokomo, Ind.; Secretary, Walter Fraine, 507 Grand Ave., Dayton, Ohio. All Correspondence should be addressed to the Secretary. The objects of this society are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. The society meets in convention in the spring of each year, subject to the decision of the executive committee. The next convention will be held at Dayton, Ohio. The branch associations hold monthly and semi-monthly meetings in their various cities.

New York Branch held their regular monthly meeting on Friday evening, June 26, at the Broadway Central Hotel. The officers were installed for the coming year and the delegate to the national convention read his report of the doings at Chicago during the convention. Herman W. Carter, of the Firestone Tire and Rubber Company, Akron, Ohio, was elected as an associate member, and Charles Werft of the Northern Ohio Manufacturing & Refinishing Company, Cleveland, Ohio, was elected to active membership. A suitable place for future meetings has not as yet been secured. A committee was appointed to make arrangements for an outing to be held some time in August.

Toronto Branch elected the following officers at their last meeting: John Magill, president; Wm. J. Salmon, vice-president; Ernest Coles, 15 Lauries avenue, Toronto, Ont., secretary. Walter S. Barrows, treasurer; Emil Nordblom, sergeant at arms; James Humphrey, librarian, and W. W. Wells, Jr., Robert Dermody and William McCann, trustees.

AMERICAN SOCIETY FOR TESTING MATERIALS

American Society for Testing Materials held their seventeenth annual meeting at Atlantic City, N. J., June 30 to July 3, 1914. At the Tuesday meeting, June 30, 3 p. m., the following papers were read and discussed:

Report of Committee B-1: On Standard Specifications for Copper Wire; J. A. Capp, chairman. Report of Committee B-2: On Non-Ferrous Metals and Alloys; William Campbell, chairman. A Rational Test for Metallic Protective Coatings; J. A. Capp. Method of Sampling and Analysis of Tin, Terne and Lead-Coated Sheets; J. A. Aupperle. Some Considerations Affecting Specifications for Wrought Non-Ferrous Materials; Wm. Reuben Webster. Study of the Strength of Non-Ferrous Castings—Comparison of Different Test Specimens; L. P. Webbert.

NATIONAL ASSOCIATION OF BRASS MANUFACTURERS

The National Association of Brass Manufacturers held their summer meeting at the Pontchartrain Hotel, Detroit, Mich., Monday and Tuesday, June 15 and 16, which meeting was well attended, and a poll of the meeting as to the business conditions showed that all things considered, the brass business was in good condition, with prospects for the future bright to good. Many topics of interest to the trade were discussed, among them the prospective adjustment of rates of classification as applying to the brass and tubular goods lines, and if the success that it is hoped for is attained, it will mean a great saving to every manufacturer who makes and ships brass goods. The meeting elected to membership the Cochrane Brass Manufacturing Company, Cleveland, O., and adjourned to meet in Cleveland, O., about the middle of September. After the regular meeting had adjourned, the List Committee spent several days at the Colonial Hotel in Mt. Clemens, Mich., on the new Official Catalog, which is to come out January 1, 1915.

PERSONALS

ITEMS OF INTEREST TO THE INDIVIDUAL.

E. Thompson, formerly with the Youngstown Fire Proofing Company, Youngstown, Ohio, is now connected with the Columbian Hardware Company, of Cleveland, Ohio.

H. M. Burrus, formerly at Walla Walla, Wash., has purchased a jewelry store at Freewater, Ore., which will be his headquarters, where he will deal in watches, clocks and jewelry and will do jewelry and watch repairing.

D. A. Johnson, who for a number of years has been assistant to the late Sam Mayer, as Chicago branch manager of the Joseph Dixon Crucible Company, Jersey City, N. J., has been appointed to the full branch management of the office.

DEATHS

Thomas Ferguson Phillips, sales manager for the U. P. Hungerford Brass & Copper Company, New York, died after an operation in the Prospect Heights Hospital on Monday, June 29. Mr. Phillips was 36 years of age, and was a son of John B. Phillips, a manufacturer of paints in South Brooklyn. He lived at 1081 Park Place, Brooklyn, and left a widow and a child.

Henry L. Gleim, who was engaged in the brass goods business, died on June 21 at his home, 436 Sterling place, Brooklyn, N. Y. Mr. Gleim was twenty-six years of age.

James N. Morehouse died at his home in Newark, N. J., June 17. Mr. Morehouse was known in this country as one of the pioneers of the electro-plating art. He started in the electroplating business in Newark, in 1894, and was teacher of the art at the Newark Technical High School for eleven years and many of his pupils now hold some of the highest positions in this country. Mr. Morehouse, at the time of his death, was carrying on an electro-plating business which will be continued by his wife who survives him.

BRIDGEPORT, CONN.

JULY 6, 1914.

The same tone is heard all over the city in regard to business at present, namely, that conditions are pretty quiet and the metal lines are affected about the same as all other industries. We have been expecting an improvement so long that many fear it will not come for some little time. The delay in announcing the freight rate decision, which, however, is looked for now at any time, has retarded the industries which would receive the most benefit from a favorable decision. Although we hear reports of railroads buying, they are not by any means the orders which ought to be placed in order to take care of the large crops predicted for this summer. Optimists are hopeful on account of this report of the crops and also point to the better tone to the steel market in the past month. This city, however, feels a slump in the copper market more than steel and at present copper is very quiet. The aluminum market has also slumped a little and practically no aluminum is being imported. There is still a good deal of comment on the President's attitude toward business and most of the deep thinking commercial men feel that Congress ought to give the country a rest from legislation.

The copper rolling mills are very quiet and in the manufacturing end of the brass goods industry reports are that orders have dropped off considerably, necessitating a five-day-per-week schedule. In discussing the past month's business with one of the heads of a large electrical goods company it was learned that they have been quite busy, although not as much so as in April and May, which months were the only ones so far to show an improvement over 1913. The outlook does not seem to be good, however, even considering the fact that business usually picks up in August.

Manufacturers of brass and iron wire cloth, screens, etc., report orders as below normal and the trade generally quiet. In the valves, fittings and plumbers' supply line business is considered fair, although one of the largest concerns is running only five days a week and is not pouring as much brass and iron as usual. Metal patternmaking concerns are mostly rushed, contrary to the general trend, but they have been busy all through the present depression.

The aluminum foundries are generally finding things quiet, but hope for renewed activities later in the summer. The automobile concerns are keeping up their end very well and the body builders are in consequence very active, also turning over their share of the work to the aluminum foundries. Vacuum cleaner concerns are not as busy as in the past few months. Bicycle and motorcycle parts manufacturers are working at about the same rate as heretofore.

Dudley Morris, treasurer of the Hawthorne Manufacturing Company, Bridgeport, Conn., brass goods and bicycle lamp manufacturers, has resigned his position with them.

The Fairfield plant of the Aluminum Castings Company has undergone a change in management. Sidney Becker, who has been manager since 1911, has been transferred to the sales department of the Detroit office. William Van Kirk, formerly in charge of the Indianapolis office, will succeed him.—F. H. C.

NEW BRITAIN, CONN.

JULY 6, 1914.

While it is an admitted fact at all of the New Britain factories that business is far from brisk there is no occasion for any more alarm than there has been in any of the previous months. One or two of the factories even seem to be picking up a little, while others are falling behind, due to the season of the year in the main. At the Stanley Works makers of wrought steel butts and hinges, as well as cold rolled steel, it is stated that the heaviest business is done on the special orders, that the stock butt business is only fair and that the cold rolled steel business is decidedly poor.

E. M. Pratt, superintendent of the Corbin screw division of the American Hardware Corporation, stated to a METAL INDUSTRY correspondent that business at his plant is poor. Mr. Pratt states that the small wood screw business and other small screws are the only things for which there is much demand at present. Last October, states the superintendent, the factory employed about 2,600 men, while today there are but about 2,000 and other hands are being laid off every week. The practice of this concern is to lay off the unskilled hands and to retain the services of the skilled men, but, however, to make them do more until such times as business may pick up again. The Corbin screw division automatic department is unusually slow and there is practically no demand for their speedometers as this is the slack time of the year for automobile business.

At the Stanley Rule & Level Company business continues about the same. The entire factory will close down during the week following the fourth of July, and then will again resume working on the full fifty-five hour schedule. P. & F. Corbin will close down but two days for the Fourth.

One of the city's most prominent manufacturers states that in his opinion business is practically as good today as it was a year ago, but does not appear so because, he says, the various concerns have enlarged so much during the past year. Almost all of the bigger concerns have added four, five and six story buildings to their plants in anticipation of a greatly increased business, and when this has not come at once there is a lot of room that is idle which gives the appearance of unusual idleness.

Ex-Senator Andrew J. Sloper, president of the New Britain National Bank and secretary of the American Hardware Corporation, has just returned from an extensive tour of the European countries. Mr. Sloper is a keen observer, combining the qualities of the financier and manufacturer, and says that from his observations abroad he finds that foreign countries have not yet awakened to take advantage of the Wilson tariff. He states that England, tied up with her big builders' strike and disturbed by the Irish question, is not yet ready to use to advantage the low tariff measure, and Germany is, he asserts, the only country that the United States need fear in the metal manufacturing line. In the Fatherland everything is done to encourage the trade and nothing is done to hamper it, and the Germans are making wonderful strides in manufacturing, and are therefore far ahead of any other foreign country.

Secretary Sloper says that the Germans copy American machinery and are always on the alert to copy our methods of manufacture. Another thing which Mr. Sloper noticed was that while some of the German machines are much more clumsy than the American machines they are copied after, in other respects they turn out much finer products than the native manufacturers. There is great cause for fear from German competition to the United States' manufacturer and the danger is becoming more and more at the rapid rate they are progressing, he says.

While attending a manufacturing exhibit in Germany the local visitor saw some mortising machines that are almost exact duplicates of those by the New Britain Machine Company. He cited this simply as a proof of the fact that German manufacturers are seizing every opportunity to make use of American machines. New Britain made tools were seen by Mr. Sloper in each foreign country he visited, and Stanley rule and level planes, levels and rules were used almost exclusively.

President George W. Traut, of the Traut & Hine Manufacturing Company, has also just returned from a trip to Germany, and concerning manufacturing as he observed it he has practically the same statements to make as did Secretary Sloper.—H. R. J.

PROVIDENCE, R. I.

July 6, 1914.

The conditions among the metal trades concerns in this city and vicinity are about as bad as they have been at any time during the past decade and, from the present indications, there appears little prospect of any material or immediate improvement. Practically all of the plants are doing something and all are endeavoring to keep their shop forces together and are running on curtailed time schedules in order to do so. A few plants report good business in particular departments and such concerns as handle or produce some special line are also among those signifying some activity.

Designers, toolmakers and draftsmen are finding a trifle more work than a month ago, while the foundries and machine makers report a slight betterment. Refinery concerns, as usual at the mid-year period, are busy with work in connection with the clean-ups of the manufacturing establishments, but even this stimulation is not sufficient to demand the usual rush for this class of work. Sheet metal workers are fairly busy, especially those that are engaged on structural operations, incidental to the spring and summer alterations and new building.

The jewelry business, as a whole, shows no improvement over that of the past three months and there is little prospect for anything approaching normal schedules for some months to come. Never, since 1873, has this industry suffered so seriously from depression as at present. For the first time in a number of years the manufacturing jewelers have refrained from setting any definite vacation periods and are opening their shops with such hands as they are retaining on curtailed schedules.

The ownership of Cannon & Brown, Inc., refiners, was recently changed by the withdrawal of Messrs. Cannon and Brown. William J. Casey and Louis V. Taylor are the new owners and have assumed charge of the business. Both of the new members of the firm have been employed by the concern for many years. There will be no change in the firm name for the present at least.

William C. Codman, who for the past twenty-four years has been head designer for the Gorham Manufacturing Company, left the early part of last month for England, where he will permanently reside, having severed his connection with the Gorham company on June 1.

The Samuel L. Anshen Company has been incorporated in this city with a capital stock of $10,000 for the purpose of manufacturing, buying and selling jewelry. The incorporators are Samuel L. Anshen, William A. Piacontini and Irene Bentley.

The Providence Co-operative Sheet Metal Company has the contracts for the sheet metal front for the new Gaiety Theatre being erected on Weybosset street, this city, and for the metal work on the new fire station for this city, to be located on Pond and Franklin streets.

Owing to the recent death of Frank T. Pearce and Aldridge G. Pearce there has been a reorganization in the manufacturing jewelry firm of F. T. Pearce Company. D. M. Wall, who has been with the company since 1879 as foreman, has been elected president and general manager, and J. J. Laney, of Buffalo, N. Y., has been elected secretary and treasurer.

The new plant of the Hope Foundry Company, which recently moved from Warren to Auburn, is now in operation. It is located between the plants of the General Fire Extinguisher Company and that of the Standard Machinery Company.—W. H. M.

BOSTON, MASS.

July 6, 1914.

Although midsummer should be a rather busy time with many of the metal workers, in the matter of preparation for fall business, there are few of the platers in nickel and silver shops who can call the demand made upon them for regular output brisk, and some are willing to admit that the season is unusually dull.

Manufacturers of silverware are doing more business, according to the general run of reports, than workers in a number of other metal lines. The June retail trade among the jewelers of this city was better than had been expected, and the silverware shops have profited from the fact that much of the presentation business, incidental to June weddings, graduations and the opening of the field sports season, led to a fair call for silver, and this in turn has been reflected to some extent since in replenishment orders to bring stocks up to normal that were drawn upon during the month.

The Tuttle Siler Company, for instance, which has recently broadened out its business, making up a line of patterns of table ware and putting them upon the market, reports the booking of excellent orders as the result of trips by Mr. Dolan of the firm to principal cities along the seaboard. This, added to the repairing and replating business of the house, makes it one of the busy shops. The Revere Silver Company reorganized last month, and is making a strong bid for trade along similar lines. The Woodman-Cook Company, which had a silver plated ware factory in Portland, Me., and up to a few years ago maintained a Boston selling office, has closed the manufactory, and probably will not reopen, it is stated.

Among the chandelier manufacturers the business is moderate. The unrest of the employees, which has been a frequent cause of differences between employers and employed for a year or more in this line of trade, is less in evidence of late, which may be taken to mean that the workers deem it discreet, in view of prevailing trade conditions, to keep their union activities for a while in abeyance.

The Salem fire bids fair to create a lot of new business in building and interior fitting lines, as soon as the work of reconstruction gets under way, and considerable expectancy is based upon this factor in the present situation.

Charles S. Taylor, head of the Boston Nickel Plating Company, who is the mayor of the suburban city of Medford, in which capacity he has served for a couple of years, is likely to be a candidate for a third term. Mr. Taylor is taking a vacation at his summer home in Maine.—J. S. B.

BUFFALO, N. Y.

July 6, 1914.

There has been a decided drop in the metal business in this locality since last month. Not only amongst the foundries, but also the electroplaters and brass finishers. Some of the larger firms are only working part of their forces three or four days a week, while the other men are being laid off for an indefinite period. Some of the smaller concerns are contemplating shutting down if business does not pick up in the very near future. In some instances where the plants are working, only certain departments are in operation. One firm which does 90 per cent. of the brass rail work in Buffalo, who have been working their forces overtime up until recently, have dropped just below its normal amount of business.

Labor is plentiful, as there are about ten men for every man working. As a result, employers have found that their employees are doing better and more work than ever before; this has been attributed to their fear of being laid off. Some of the foundry men are very pessimistic about the present condition of affairs, claiming that the Administration is taking too drastic an action against big business. This resulting in their not doing very much because they do not know where they stand is indirectly affecting the smaller concerns who are to some extent depending on the larger concerns for business. Buyers are only buying in small quantities, and then they usually want it in a rush, causing an unnecessary expense which would not have to be made had business conditions been normal. And in order to get business and to keep their shops agoing some of the local concerns are cutting their own price. However, all local concerns expect that business will return to its normal condition by next fall.

The new workmen's compensation act that becomes operative July 1 in New York State has caused a great deal of anxiety on the part of the smaller concerns, particularly those manufacturing specialties. The New York State concerns are handicapped by their competitors, whose place of establishment is located in a State where no workmen's compensation law exists, say local men. The insurance rates being somewhat high, the metal concerns cannot afford to charge it to office expense, therefore it has to be added to the price of the work. As a result, the competitors in non-workmen's compensation States will take advantage of this situation and deprive the local concerns of that to which they are entitled.

Last month W. G. Grove, W. T. Stewart, Nelson B. Grove,

Susan M. Grove and George Heintz filed a certificate in Erie County Clerk's Office to assume the name Unique Brass Foundry Company. They expect to soon break ground for a new $25,000 steel brick foundry in the Black Rock district. The building will be "L" shaped, facing on two streets and backing on the railroad. The foundry will be a 50 x 85 foot one-story structure, with a core room adjoining the foundry, which will be 50 x 30 feet. The offices, pattern and machine shops, etc., will be located in a two-story 40 x 85 foot structure, adjoining the foundry and core room, facing on one of the other streets. At present their foundry is located at 25 Illinois street, where they make all sorts of brass, bronze, aluminum castings, etc.

The National Bronze Foundry since moving in their new quarters on Niagara street have equipped themselves for a fifty per cent. increase in their output capacity. They are now able to handle any kind of casting up to 1,500 pounds in brass, bronze, aluminum or any other metal.—G. W. G.

The Buffalo Manufacturing Company of 191 Clinton street, who made all kinds of brass and copper metal goods, have taken up a new line of electric heating and cooking lines.

The Star Plating Works have enlarged and put in new nickel tank and polishing machinery. They expect to build an addition to their plant.

The Medina (N. Y.) Iron and Brass Company completed the erection of an extensive plant.

The Central Foundry Company of Syracuse, N. Y., incorporated to make brass, bronze, aluminum and white metal castings and to specialize in vacuum cleaner tools.

The Eastman Kodak Company, of Rochester, have a new method of exhausting the fumes from the electroplating department in order to safeguard the operators. A cover is placed over the plating tanks to prevent the fumes from getting out and to protect the tanks and contents from dirt, dust and oxidization.

The Electric Steel & Metal Company will build a smelting plant at Welland, Ont., and expect to employ two hundred hands.

The American Bronze Company of 90 Arthur street have started the erection of a two-story brick factory, to cost $20,000. A foundry is also included.

The Turner Bearing Company have started the erection of a brick and steel foundry at 1155 Sycamore street, to cost $30,000. This firm have been compelled several times to expand, owing to the great growth of their business.

The Dobel Manufacturing & Plating Company have equipped their plant with new plating and polishing equipment.

The Titan Copper Products Company will establish a manufacturing plant here.

The Crosby Company, of 182 Pratt street, manufacturers of sheet metal stampings, have built a new factory building to increase their production twenty-five per cent.

The Art Work Shop discontinued the manufacture of jewelry and are now doing a business of making copper, silver and bronze objects, plating and mesh bag repair work.—H. S.

NEWARK, N. J.

July 6, 1914.

Business has been very slow all the year so far and Newark has seen the dullest period as a whole in twenty-five years. All lines seem to have no life at all. The factories have been working on short time and are merely holding on, expecting trade to pick up later. Some lines have been severely hurt by the tariff. There is no movement of gold, silver or platinum goods, the jobbers and retailers holding off from making their usual purchases. Many plants are shut up, some working on half or third time, and some on twenty-four hours a week. All metal lines are quiet and there is little activity in any direction.

The Lindsay Metal Novelty Works at Boyden Place are making brass and German silver novelties.

The Balbach Smelting & Refining Company have built a new factory building at Bay Front, at a cost of $3,000.

The Newark Art Foundry, manufacturers of gold, silver and bronze casting on Franklin street, has gone out of business.

The Metal Treating & Equipment Company was organized a year ago at 1784 Broadway, New York City, with a capital stock of $100,000 to exploit their patented processes and solutions for electro galvanizing and installing job galvanizing or special plants. It is said this solution permits the deposition of any desired amount of zinc.

The Syracuse Smelting Works at 147 Jewell street, Brooklyn, have built an addition to their plant. They are making the Stanley process of Babbitt and white metal.

The Bateman Manufacturing Company, of Greenloch, N. J., have just finished the erection of a new plant to take place of the one recently destroyed by fire. The building is of brick and steel and modern equipment for gray iron and brass founding has been installed.—H. S.

TORONTO, ONT.

July 6, 1914.

The Canadian National Exposition, held in Toronto each year, will this fall have a large exhibit of the jewelry manufacturers of Attleboro, Mass. This will be the first year such an attempt has been made. There will be the usual large exhibits of the metal trades and the attendance is showing an increase each year.

John Collins, who formerly had charge of the American Electroplating Company, has taken charge of the plating department of the Computing Scale Company.

The Standard Silver Plate Company have built a new modern factory with the latest improvements and have one of the most complete factories in Canada. They employ about three hundred hands and are connected with the International Silver Company of Meriden, Conn.

Roden Brothers, large manufacturers of sterling and silver electroplated medals and trophies, are erecting a new factory having a floor space of 35,000 square feet.

Wilson and Cousins, brass founders, have moved from 16 Sheppard street to McCaul street, near Queen.—H. S.

DETROIT, MICH.

July 6, 1914.

Business conditions in the non-ferrous metal lines look very promising this month in Detroit The factories manufacturing brass goods for the automobile trade are now running to their full capacity, as the automobile busy spring season is at its height at the present time. The Packard and Lozier factories are running day and night to supply the demand for high grade cars.

Upwards of one hundred concerns in Detroit are engaged in the brass and aluminum industry. There are few things manufactured from these metals that are not produced here. Plumbing supplies and auto parts, in particular, are manufactured in great quantities, but during the last month or so every plant has been operating under extremely economical methods, and but little is being done at the present time. Manufacturers, however, believe July and the greater part of August will be quiet, but are anticipating decided changes for the better when the early fall opens.

Detroit banks are reported full of money and ready to place it in circulation as soon as they see better times ahead. These are anticipated as soon as the full extent of the crops are known, which are reported all over the Middle West to be the greatest in the history of the country. While politicians may declare that the present administration is the cause of all the trouble, Detroit manufacturers believe political conditions will not keep business down, but that full grain elevators in the West will bring back the old prosperity.

John Fezzy, manufacturer of trolley wheels, states that the brass business, in which he is engaged, still continues to move the same as it has during the last two months, and is not anticipating any material change until some time later in the fall.

The Ford Motor Company, which was announced last month as constructing many new buildings, is planning for additional expansion, and is arranging to double its plant, with the ultimate aim of obtaining facilities for employing 40,000 men. The brass and aluminum plant will be one of the largest in the world. Heretofore the Ford company has obtained much of this material from outside sources, but is now planning more and more to do all the work under its own roof.

Nothing of consequence is now in sight in any branch of the brass and aluminum trade here at present, outside that mentioned, except perhaps that which is found at the Detroit Shipbuilding Company's plant where a large number of big lake freighters are in process of construction. Great quantities of brass and aluminum are used in the construction of these boats.

This company has one of the most complete brass foundries in the city. Many boats will not be completed until late in the fall and will not make their appearance on the lakes until next spring. Two new passenger boats, the North American and the South American, have been completed during the last month and now are in operation between Detroit, Duluth and Buffalo.

The Detroit Brass & Copper Works, large manufacturers of brass pipe and tubing, report business as normal at this time of the year. As Detroit is the central point in the manufacture of lubricators' injectors and oil cups used on locomotive and stationary engines, the manufacturers of this line of goods are very optimistic over the trade situation. It would seem that crop prospects are very good and they are also looking forward to get relief from Washington. They will be able to do a good fall business, as the railroads of the country are their best customers.

The National Association of Brass Manufacturers held their midsummer meeting here at the Pontchartrain Hotel the 15th and 16th with a fair attendance. The Central Supply Association were also in session at the same time. They are composed of jobbers in plumbing and steam supplies.—P. W. B.

LOUISVILLE, KY.

JULY 6, 1914.

Louisville coppersmiths report business at this time worse than seasonably quiet. Things are generally dull at this season when the distilleries have been closed for the summer, so repair work is naturally light. This year, however, there is practically no new work in the distillery line to be had and, while some of the coppersmiths have some desirable contracts in the way of commercial castings and some cannery work, there is little doing. Collections have been good, however.

Hines & Ritchey are running their plants an full time at present on a lot of special work in the way of copper tubing and special castings to be used by the United States Bottlers' Machinery Company, which manufactures machines for the United States Bottlers' Supply Company, the selling agent. The Bottlers' Machinery Company has leased the patent rights from the Fields Company, of Terre Haute, Ind., on some special machinery for canning factories, and it is this work that is keeping the Louisville firm busy.

Elmore Sherman, president of the Vendome Copper & Brass Company, has spent a good deal of time during the past two months at New Orleans, La., where he is putting up the new 1,000 bushel distilling plant for the Algiers Distilling Company. This plant will be constructed for handling rye, bourbon and spirits and the still will be of the continuous pattern. Several good repair jobs are in sight, according to C. J. Thoben, the secretary of the company, but outside of a little work for canneries there is very little being done at present.

W. P. Davis, who is the leading sheet and tube copper dealer of Louisville, returned from a trip to New Orleans recently, and left almost immediately for Atlanta, Ga. Sheet copper at present is bringing nineteen cents, but the demand is small. Only small jobs are to be had at this time and the copper workers are not likely to be busy until August and September when the distillers begin to overhaul their plants for the fall run.

The Laib Company, of Louisville, which handles a general line of wholesale plumbers' supplies, including sheet lead and copper and brass tubing, have completed a large new plant at Eighteenth street and Magnolia avenue, where they are located on the Southern Railroad. The concern will continue the old store at Fifth and Main streets which has been rebuilt after being completely gutted by fire a few months ago. The new plant is one square in length and has 40,000 feet of floor space. Shower baths for the workmen and rest rooms for the girls in the office have been supplied. A day of inspection was set aside shortly after the company moved into its new quarters, and all the plumbers and metal workers were invited to look the plant over. Refreshments and cigars were served.

Charles Schad, of the Independent Brass Foundry, has returned from a vacation trip to Atlantic City, N. J., and his partner, J. W. Rademaker, will leave shortly for a trip to the East. Business at the local foundry is holding up nicely just now. A good deal of casting for the local elevator companies is being handled. The firm is also making a lot of patterns in metal for B. F. Avery & Sons, large plow manufacturers of this city. A quantity of government work was also recently ordered in the shape of fittings for railings on the United States vessels.—G. D. C., Jr.

COLUMBUS, OHIO

JULY 6, 1914.

The metal market in Columbus and central Ohio rules quiet in every respect. There is little demand for any variety of metal, and as a consequence prices are very irregular. In fact the market is the most quiet in years and there is little hope for improvement in the immediate future. No new metal using concerns are being organized, and those which are in operation are running with a reduced force. On the whole there is little to say concerning the trade with the exception that stocks have accumulated and jobbers are unable to dispose of them.

The copper market is very quiet in every way and no regular prices are being quoted because of lack of demand. In the brass trade unsteadiness rules—yellow brass scraps are quoted at 8¾ cents to the trade and red brass at 11½ cents. Aluminum is also quiet and sells to the trade from 18 to 19 cents. Babbitt metal is not in good demand and the same is true of other metals.

The National Sanitary Company of Massillon, Ohio, has been incorporated with a capital of $500,000, to make enamel ware, by Fred H. Snyder, Jacob Snyder, Charles Snyder, Louis F. Mangen and Richard Johnson.

The Zahner Metal, Sash and Door Company of Canton, Ohio, has increased its authorized capital from $2,000 to $600,000.

C. Edward Born has been named receiver for the American Metal Specialties Company of Columbus, under a bond of $3,500. The trouble was started by the arrest of John Mackie, manager of the company on the charge of embezzlement.—J. W. L.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Plume & Atwood Manufacturing Company, manufacturers of brass and brass goods, is preparing to construct an addition to its factory on Bank street, Waterbury, Conn.

The Amboy Works, Perth Amboy, N. J., manufacturers of brass and bronze fixtures, plans to remove its plant to another local site. The erection of a new plant is now under consideration.

The General Aluminum & Brass Manufacturing Company, Detroit, Mich., are building a new machine shop under a building permit which allows for a structure to cost about $35,000.

Plans have been figured for an addition to the works of the A. H. Wells Company, Waterbury, Conn., manufacturers of copper and brass tubing. The addition will be 70 x 90 feet and one story high.

The E. J. Woodison Company, manufacturers of foundry and platers and polishers' supplies, Detroit, Mich., announce that they have opened a branch at 378 Ellicott Square Building, Buffalo, N. Y., to be under the management of Pierce G. Smith.

The Lumen Bearing Company, brass founders, Buffalo, N. Y., report that the Toronto branch was closed early in the year because of business conditions. The land is now offered for sale, together with the buildings which are reported to be in good condition.

The United Metal Works, of Bridgeport, Conn., a newly organized company, will incorporate for $5,000, to manufacture metal lighting fixtures. The officers of the concern are as follows: H. Abrams, president; M. J. Hatfield, vice-president; A. E. Wollard, secretary, and H. Abrams, treasurer.

Emanuel Blassett, Jr., Burlington, Vt., recently installed the gun metal process for finishing metals at the plant of the Union Cutlery Company, Olean, N. Y.

W. W. Wells, Toronto, Ont., Canada, manufacturer and dealer of electro-platers' supplies, is building an extension on the front of his factory three stories in height and which will be used for office purposes.

The Massillon Aluminum Company, Massillon, Ohio, are erecting a new three story brick building which they expect to have in operation within thirty days. At present they are operating a brass and aluminum foundry. They will manufacture a line of sheet metal cooking utensils.

The report that extensions were being carried on at the Coe Brass Company, branch of the American Brass Company, at Torrington, Conn., at a total cost of $150,000, has been denied by E. J. Steele, vice-president, who states that nothing of this kind is being done or being considered at this branch.

The new office building of the United States Aluminum Company, New Kensington, Pa., is rapidly nearing completion. This building, which is 203 by 80 feet, is being erected on a lot 100 x 260 feet and there will be plenty of space left for flower beds and lawns, thus making the whole operation very attractive.

Landers, Frary & Clark, manufacturers of hardware specialties, New Britain, Conn., will build three new buildings of brick in the rear of the present plant. One will be 24 x 126 feet, three stories, which will be used as an addition to the celluloid department. One 40 x 123 feet will be used for a forge shop and the other 30 x 140 feet one story, will be used for a tinning shop.

The Goldschmidt Thermit Company, New York, are now manufacturing and carrying in stock 10 per cent. Cobalt copper, 10 per cent. chromium copper. These alloys are made from pure metals and are technically free from iron, carbon and other impurities. They have a very low melting point and excellent results are being obtained by using same.

Manning, Maxwell & Moore, New York, N. Y., have awarded the contract for the large additions to the Putnam Machine Company plant at Fitchburg, Mass. The new machine shop will be 224 x 300 feet, one and two stories; the foundry, 120 x 200 feet, one and two stories; pattern storage building, 53 x 104 feet, four stories; power house, 50 x 88 feet, and office building, 53 x 105 feet, one story.

The Southern Aluminum Company, Whitney, N. C., has made arrangements to issue $7,000,000 6 per cent. bonds to be used in construction. The principal officers of this company reside in Paris. The concern is represented in the United States by the American Metal Company, which has an important ownership in the property. The output at the start will be about 25,000,000 pounds annually.

The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y., announces that it has organized a bronze department for the manufacture of titanium-bronze specialties under its various patents, and that Wm. M. Corse, formerly works manager of the Lumen Bearing Company, Buffalo, and lately general manager of the Empire Smelting Company, Depew, N. Y., will be associated with the company as manager of this department.

C. W. Leavitt & Company, 30 Church street, New York, have been appointed agents for the carbon-free metals and alloys manufactured by the Iron and Steelworks Mark, Wengern-Ruhr, Germany. A new bulletin has been issued which gives complete descriptions of these alloys and the uses for which they are adapted. This same company is introducing "Manfecual," which was described in THE METAL INDUSTRY for June.

The Wells Chemical Bronze Works, Worcester, Mass., manufacturer of non-ferrous metal castings, will build a new plant in that city at Harding and Temple streets, to replace the property on Summer street which was recently sold. The new building will be 40 x 60 feet, and will comprise the office at one end, the upper floor being used for pattern storage. This end of the building will be separated from the foundry by a fireproof wall. A basement under the building will be used for storage purposes.

The Aluminum Goods Mfg. Company, Two Rivers, Wis., is now running its plant exclusively in the production of army canteens, the War Department having contracted for 85,000 canteens on a 4,000 per day delivery schedule. Until the contract is executed the Manitowoc plant will take care of other work in hand at Two Rivers. As already reported, the Manitowoc plant will be greatly enlarged during the last half of the year. The Two Rivers plant is operating two 10-hour shifts daily, except Sunday.

The Schultz Bronze Company, announce that it is now located in Boston, Mass. Associated with this company are L. R. Schultz, formerly of the Pittsburgh Architects Bronze Works, and Hans Fritz Muschler, formerly with Delaunay, Paris. The company imports French models and deals in ecclesiastical and art bronze work—makes fac-simile bronze reproductions from hand chased models of bas-reliefs, appliques and moulures in galvanoplastie massive—and specializes in sectional nickel plated copper molds.

The reorganization of the Pratt & Cady business at Hartford, Conn., has been completed by the formation of a new corporation known as the Pratt & Cady Company, Inc. The officers are Walter B. Lashar, Bridgeport, Conn., president; Bishop White, Bridgeport, Conn., treasurer; W. F. Whitmore, Hartford, Conn., vice-president and general manager; E. L. King, Hartford, Conn., secretary. Mr. King was the receiver of the old company. The new organization will continue the manufacture of valves and hydrants.

The Bremer-Waltz Corporation, 30 Church street, New York City, has been organized with W. S. Bremer, president; J. L. T. Waltz, secretary and treasurer, to handle aluminum in all its forms, including the buying of crude aluminum and the selling of sheets, circles, squares, shapes, etc. This company controls the entire output of the Standard Rolling Mills, Two Rivers, Wisconsin, and any proposition concerning aluminum will receive the careful consideration of its officials. The general manager, J. L. T. Waltz, has been actively engaged in the importation of aluminum for many years, having been connected with Guiterman, Rosenfeld & Company, well known importers, for the past thirteen years, so that he is thoroughly familiar with this line of business.

The National Company, of Waterbury, Conn., about to engage in the manufacture of seamless brass and copper tubing, expects to be ready for business very soon. The plant, which is now nearing completion, is designed along the most modern lines, being fireproof throughout. It has been the purpose of the officers of the company to provide a factory in which every inch of space is light and sanitary. The machinery and other equipment is of the latest and most improved design. Electricity will be used throughout for light and power. The building, standing as it does beside the railroad track, alone, on a tract of land owned by the company containing over nine acres, presents a most attractive appearance. It is of steel construction, with a 3½-foot brick base and sash 11 feet extending all the way around the building, all painted white, and can be seen at a considerable distance from any direction.

STOCK DIVIDEND

Stockholders of the Bristol Brass Company, Bristol, Conn., have received notice from Secretary J. R. Holley of the amount of stock that would be allotted them as a result of the distribution of the American Silver Company's capital stock. The votes of the stockholders and directors of both the Bristol Brass Company and the American Silver Company provide for the increase of the capital stock of the American Silver Company to the sum of $400,000. The $200,-

000 outstanding is to be distributed to the stockholders of the Bristol Brass Company as a special dividend. A new issue of $200,000 when authorized is to be taken by the Bristol Brass Company at par and in payment for the same the debt of the American Silver Company to the Bristol Brass Company is to be canceled and the balance of about $40,000 is to be paid in in cash.

REMOVAL NOTICES

The Art Metal Shop, formerly located at 63 West Huron street, Buffalo, New York, has removed to 445 Ellicott square.

The Rochester (N. Y.) office of the Aluminum Company of America, formerly located at 406 Powers Block, has been moved to the Granite Building.

The Bellingham Brass Mfg. Company, formerly located at South Bellingham, Washington, has removed to 228 Twentieth avenue, Seattle, Washington.

Laggo Metal Art Specialties Company, formerly located at 301 East Twenty-first street, New York City, have removed to 225 West Thirty-ninth stret.

The Farnum Dental Laboratory Company, formerly located at 36 W. Rand street, Chicago, Illinois, has removed to the Marshall Field Annex.

E. Reed Burns Metal Polish and Supply Company, manufacturers of and dealers in nickel and electro platers' supplies, Chicago, Ill., announce that owing to lack of space and fast increasing business they are compelled to move to larger quarters and will occupy the three-story fireproof building located at 412-414 North Morgan street, Chicago, Ill., where they will be in a position to increase the output of their compositions, buffs and general plating supplies. The company also reports that on account of the constant demand for their tripoli composition they are installing another machine for the manufacture of same and which will enable them to turn out a larger supply to meet the demands of the trade.

ELECTION OF OFFICERS

At the annual meeting of the stockholders of the Easton Brass & Machine Company, Easton, Pa., the following officers were elected: President and treasurer, George D. Sherry; secretary, A. Stevenson. The board of directors is composed of G. B. Sherry, E. Sherry and A. Stevenson.

BUSINESS TROUBLES

The final meeting of the creditors of the Levett Manufacturing Company, Matawan, N. J., was held at the bankruptcy court room, Freehold, N. J., July 9, but further details are not obtainable at the time of going to press. The account of the trustee shows receipts of $15,019.45 and disbursements of $11,026.25.

INCREASE IN CAPITAL STOCK

Western Lamp and Brass Company, Chicago, Ill., have increased their capital stock from $10,000 to $20,000. They report that they have just moved into their new six-story building at 156 West Lake street, the main floor of which contains the show and sales rooms and general office, while the rest of the building is given to the manufacture and stocking of their goods.

CHANGE OF FIRM NAME

The Majestic Furnace & Foundry Company, Huntington, Ind., will change its name to the Majestic Company and have completed the addition of a story to its machine shop and also the enlargement of the furnace room. These additions will enable them to increase their capacity one-third.

H. E. S. Thompson & Company has succeeded to the business of Thompson & Patterson, platers of Attleboro, Mass. Mr. Patterson withdrew from the firm some time ago, and Mr. Thompson has been conducting the business alone since that time. Henry D. Lecoste has bought an interest in the business and the name has been changed to meet the new conditions. Besides a plating department this concern also operates a polishing and lacquering department.

FOREIGN TRADE OPPORTUNITIES

[In applying for addresses at Bureau of Foreign and Domestic Commerce, Washington, D. C., refer to file number.]

No. 13227. Plated ware.—An American consul in a European country reports that a firm in his district dealing in sheet iron and doing plating and galvanizing, wishes to be placed in communication with American houses manufacturing plated ware in large quantities.

No. 13218. Metallic letters and numbers.—A report from an American consul in India states that a local industrial works is desirous of getting in touch with American firms manufacturing metallic letters and numbers. Correspondence should be in English.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture metal products.—The McGill Metal Company, Valparaiso. Ind. Capital $100,000. Directors, J. H. McGill and H. W. and L. M. Harrold. This concern will operate a brass foundry, brass machine shop, plating, polishing and stamping department

To manufacture springs, wire and metal stampings.—Miller & Van Winkle, Inc., Brooklyn, N. Y. Capital $150,000. Incorporators: Edward N. Miller, president, and Clarence L. Miller, secretary and treasurer. This company has been incorporated to take over the co-partnership of Miller & Van Winkle, which has been established for the past thirty years.

PRINTED MATTER

Metal Prices.—The American Brass Company, Waterbury, Conn., have issued their new price list No. 10 which shows extras over base price for metal and which were effective July 1, 1914.

Electric Hoist.—Pawling & Harnischfeger Company, Milwaukee, Wis., have issued Bulletin 301A, which gives some very interesting data on the application of their electric hoists. Some very complete installations of these hoists are included in the pamphlet.

Insulating Brick.—The Armstrong Cork Company, of Pittsburgh, Pa., have issued a thirty-two page booklet giving full description of the "Nonpareil" insulating brick which is used for boiler settings, furnaces, stacks, kilns, bake ovens, stills, etc. Copies of this booklet may be had upon request by addressing the publicity department of the above company.

Lubricant.—The Lumen Bearing Company, brass founders, Buffalo, N. Y., have issued a new booklet in which they describe "Lesoyl." "Lesoyl" is a graphite concentrate which the company has produced in the development of other engineering work as bearing specialists and they are now ready to market this compound. The booklet is now ready for distribution.

Year Book.—The Merchants' Association of New York has issued a Year Book for 1914. This book, which consists of 212 pages, gives the full account of the activities of this association, whose object is to foster the trade and welfare of New York, for the past year. The greater part of the book is taken up with the list of members, which is divided

into forty-eight divisions. An alphabetical and classified index completes the book.

Milling Machines.—Catalog No. 48 has just been issued by the Newton Machine Tool Works, Philadelphia, Pa. This catalog, which consists of forty-eight pages, gives complete descriptions and illustrations of the Newton line of milling machines which have been continuously used for over thirty years and at all times have represented th ehighest point of development in this kind of equipment. Copies of this interesting catalog will be sent upon request.

Testing Laboratory.—The Detroit Testing Laboratory, chemists and metallurgists, Detroit, Mich., have issued a booklet giving full description of the laboratories and the kind of work that they are equipped to perform. This laboratory is engaged in industrial and chemical research and the booklet sets forth very clearly the relations between this research work and every-day commerce. The booklet also contains some fine photographs of the staff, offices, work rooms and laboratory.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

New York, July 6, 1914.

COPPER.

The copper market was very dull in May, but it has been much worse during June and for the last half of the month there has hardly been any buying at all. Several days last week there were no inquiries in the market for any deliveries.

Producers are supposed to be asking 13½ cents delivered thirty days for electrolytic against 14¼ a month ago. One of the leading producers declines to sell at this price and is practically out of the market.

The increase in domestic stocks, as shown by the statement of June 8 of the Copper Producers' Association, showing an increase of 14 million pounds during May, did not help the market and consumers were able to get along without buying. Since then the European stocks have increased considerably and the London speculative market for standard copper has pretty well followed the situation in America and prices in London show further declines. The price in London is around £60 against £65 a month ago and £70 a year ago.

The manufacturers have not the orders on their books and the mills are only running at about 50 per cent. to 60 per cent.

The exports for the month will be over 35,000 tons, the stocks abroad are steadily increasing and Europe will not buy unless at concessions. Electrolytic is quoted at 13⅞, Lake at around 14 and casting at 13⅜ cents.

Later: With an advance in London prices here are 10 to 15 points better.

TIN.

London prices have declined just about the same as all other metals. The price today is around £136 against £143 a month ago and £210 a year ago. Consumption for the month is estimated at about 3,500 tons and this is considered very fair in times like this. The price of tin today is around 32¼ cents and no one wants to sell futures at anywhere near today's prices.

LEAD.

The trust price has been held steady at 3.90 New York and the independents have been giving the same price on carload lots New York delivery. In East St. Louis the market is quotable at 3.80.

SPELTER.

This market has been very dull. Prices have been held fairly steady through a general decrease in output. Consumption has been light and prices would easily have broken ½ cent per pound had not the output been restricted. Prices today New York carloads 5.05 to 5.10, and East St. Louis 4.90.

ALUMINUM.

Market is shade easier at 17½ to 17¾ cents for 98 to 99 per cent. ingots, against 17¾ to 18 cents a month ago.

ANTIMONY.

Prices are about 15 points lower. Cookson's at about 7.15, Hallett's 6¾ and Hungarian grade 5½ cents.

SILVER.

Market has been dull with prices shade lower. New York 56¾ cents with London 26⅛d.

PLATINUM.

Market quiet; jewelers are not buying and the electrical companies are not very active. Ordinary refined is quoted at $43 to $44, 10 per cent. hard at $46 and 20 per cent. at $49.

QUICKSILVER.

The wholesale price has been reduced to $37 a flask, with jobbing lots at around $38.

SHEET METALS.

Sheet copper has been reduced ¼ cent to 19 cent base. Copper wire is quotable at around 14½ cents with high sheet brass (wholesale) at 13⅞ base.

OLD METALS.

Market has been very dull and Europe is not buying. Prices are all a shade lower than a month ago.—J. J. A.

JUNE MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
Copper.			
Lake	14.50	14.00	14.25
Electrolytic	14.25	13.50	13.85
Casting	14.00	13.25	13.70
Tin	31.45	30.00	30.70
Lead	3.90	3.90	3.90
Spelter	5.25	5.00	5.15
Antimony (Hallett's)	7.00	6.75	6.85
Silver	57¼	55⅞	56.47

WATERBURY AVERAGE

The average price of Lake Copper per pound as determined monthly at Waterbury, Conn.

1912—Average for year, 16.70. 1913—Average for year, 15.83. 1914—January, 14.75; February, 15.125; March, 15.00; April, 14.875; May, 14.75; June, 14.375.

COPPER PRODUCTION

The figures for the production of copper for June will be published in August.

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the Report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

Metal Prices, July 6, 1914

METAL PRICES.

	Price per lb. Cents.
COPPER—PIG AND INGOT AND OLD COPPER. Duty Free. Manufactured 5 per centum.	
Lake, carload lots, nominal	14.00
Electrolytic, carload lots	13.60
Castings, carload lots	13.35
TIN—Duty Free.	
Straits of Malacca, carload lots	31.20
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	3.90
SPELTER—Duty 15%. Sheets, 15%.	
Western, carload lots	5.05
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	23.00
100 lb. lots, f. o. b. factory	21.00
Ton lots, f. o. b. factory	17.75
ANTIMONY—Duty free.	
Cookson's cask lots, nominal	7.20
Hallett's cask lots	6.75
Hungarian grade	5.50
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad. valorem.	
Shot, Plaquettes, Ingots. Blocks according to quantity	.38 to .43
ELECTROLYTIC—3 cents per pound extra.	
MANGANESE METAL	.65
MAGNESIUM METAL.—Duty 25% ad valorem (100 lb. lots)	1.50
BISMUTH—Duty free	1.98
CADMIUM—Duty free	.95
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	2.00
QUICKSILVER—Duty 10%	.53
	Price per oz.
GOLD—Duty free	$20.67
PLATINUM—Duty free	43.50
SILVER—Government assay bars—Duty free	.56⅜

INGOT METALS.

		Price per lb. Cents.
Silicon Copper, 10%	according to quantity	25 to 28
Silicon Copper, 20%	" "	28 to 32
Silicon Copper, 30% guaranteed	" "	30 to 34
Phosphor Copper, guaranteed 15%	"	22 to 26
Phosphor Copper, guaranteed 10%	"	23 to 28
Manganese Copper, 25%	" "	25 to 29
Phosphor Tin, guaranteed 5%	" "	57 to 60
Phosphor Tin, no guarantee	" "	36 to 38
Brass Ingot, Yellow	" "	10 to 10½
Brass Ingot, Red	" "	12 to 13½
Bronze Ingot	" "	12½ to 13¼
Manganese Bronze Ingots	" "	18 to 19½
Phosphor Bronze	" "	18 to 20
Casting Aluminum Alloys	" "	16 to 18

PHOSPHORUS—Duty free.
According to quantity .... 30 to 35

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
11.75 to 12.00	Heavy Cut Copper	13.00 to 13.25
11.50 to 11.75	Copper Wire	12.50 to 12.75
10.50 to 10.75	Light Copper	11.75 to 12.00
10.00 to 10.25	Heavy Mach. Comp.	11.50 to 12.00
7.25 to 7.50	Heavy Brass	8.75 to 9.00
6.00 to 6.25	Light Brass	7.50 to 7.75
8.75 to 9.00	No. 1 Yellow Brass Turnings	8.50 to 8.75
9.00 to 9.25	No. 1 Comp. Turnings	10.00 to 10.50
3.40 to ——	Heavy Lead	—— to 3.70
3.50 to ——	Zinc Scrap	3.75 to 3.875
5.50 to 6.50	Scrap Aluminum Turnings	7.00 to 8.00
11.50 to 12.00	Scrap Aluminum, cast, alloyed	13.00 to 14.00
13.00 to 14.00	Scrap Aluminum, sheet (new)	14.00 to 15.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 23.00	Old Nickel	20.00 to 23.00

PRICES OF SHEET COPPER.

BASE PRICE, 19 Cents per Lb. Net.

SIZE OF SHEETS. Width.	LENGTH.	64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
		Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered at its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLER COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper .... 1c.

ZINC—Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill ....7.00 basis, less 8%
Casks, jobbers' prices .... 7¾c.
Open casks, jobbers' prices .... 8¼c.

Metal Prices, July 6, 1914

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect June 15, 1914, and until further notice.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.13⅞	$0.15⅝	$0.17
Wire	.13⅝	.15⅝	.17
Rod	.13⅝	.16⅜	.18
Brazed tubing	.18⅝	——	.21⅞
Open seam tubing	.18⅝	——	.21⅞
Angles and channels, plain	.18⅝	——	.21⅞

50% discount from all extras as shown in Brass Manufacturers' Price List.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.15⅛	$0.16⅞	$0.18¼
Wire	.14⅞	.16⅞	.18¼
Rod	.14⅞	.17⅝	.19¼
Brazed tubing	.19⅝	——	.23
Open seam tubing	.19⅝	——	.23
Angles and channels, plain	.19⅝	——	.23

Net extra as shown in Brass Manufacturers' Price List.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

BARE COPPER WIRE—CARLOAD LOTS.

14¾c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	20c.	per lb. base
100 lbs. to 300 lbs. in one order	20½c.	" " "
Less than 100 lbs. in one order	22c.	" " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, 16c. per lb.
Seamless Copper Tubing, 19½c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
24	23	18	17	16	16	16	16	16	16	16	17	18	20	22	23

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1⅛ inch	22	24
1¼ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	60

Discount 55-5%.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	17½c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	14½c.	" "
" " " Rectangular sheets other than Sheathing	17c.	" "
" " " Rod	14½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 23½c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 4c. over Pig Tin. 50 to 100 lbs. 5c. over, 25 to 50 lbs. 7c. over, less 25 lbs. 9c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Gauge.	Width. Inches.	1 ton.	500 lbs.	50 lbs.	Less than 50 lbs.
20 and heavier	3-30	30c.	34c.	36c.	38c.
21 to 24 inclusive	3-30	32c.	35c.	37c.	39c.
	30-48	33c.	37c.	39c.	41c.
	48-60	39c.	40c.	42c.	44c.
25 to 26	3-30	33c.	36c.	38c.	40c.
	30-48	35c.	38c.	40c.	42c.
27	3-30	36c.	37c.	39c.	41c.
	30-48	39c.	40c.	42c.	44c.
28	3-30	37c.	38c.	40c.	42c.
	30-48	40c.	41c.	43c.	45c.
29	3-30	38c.	39c.	41c.	43c.
	30-48	42c.	43c.	45c.	47c.
30	3-30	39c.	40c.	42c.	44c.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. No charge for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.

Outside Diameters. BASE PRICE, 24 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 in.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	26	23	..	..	13	19	9	8	15	22
12.	.109.	..	..	..	..	..	..	..	25	..	..	..	14	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..
16.	.065.	..	..	..	..	..	27	26	26	23	22	20	20	20	20	26	30	36
18.	.049.	..	..	..	..	32	29	28	27	24	25	25	25	..	..	..	..	..
20.	.035.	116	..	45	38	33	32	31	29	28	29	29	29	30	37	48	57	80
21.	.032.	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	137	97	47	41	37	36	34	33	..	..	44	..	..	..	..	..	..
24.	.022.	187	132	107	87	78	72	61	59	65	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb.	33	33½	33½	34	34½	35	35½	36	37	38	39	44	47

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	18¼c.	16%	22¾c.
8%	20c.	18%	23¼c.
10%	20½c.	20%	25½c.
12%	21½c.	25%	33¾c.
15%	22½c.	30%	39¾c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	19¼c.	15%	26½c.
8%	21c.	16%	27½c.
10%	22½c.	18%	29¼c.
12%	24½c.	30%	45¼c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.